Globalization and the Public Sector

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Preface

In writing this dissertation I have benefited greatly from conversations and interactions with many people whom I would like to thank and acknowledge their role in my dissertation.

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Introduction

Globalization produces greater economic interconnections between countries and an increase in international goods and capital flows. As a result, it is more likely that shocks, positive or negative, do not stay isolated where they occur but spill over the borders of nations and affect other countries. The financial crisis in 2008 and the associated tide of events in the last two years are clear indications of the extent to which globalization has developed and how strongly the world is linked. Governments all over the world have reacted heavily and intervened in order to prevent the worst. They have spent an enormous amount of money to try to save banks and firms. This is just one salient example which shows us that the role of governments, their behavior and the corresponding public spending is heavily affected by and connected to the degree of globalization. The financial crisis is also an example of how globalization can lead to greater risks and that the welfare state as a relatively safe harbor and rescuer compensates for some of the occurred losses and, as a result, is forced to expand. This role of the state is not restricted to financial crises but a much more general phenomenon. In a seminal paper Rodrik (1998) explains that open countries have 'bigger governments' because governments provide insurance against the greater risks associated with globalization, in particular, also with international competition in the goods market. The argument contrasts the situation in the 1990's when several governments made a big effort to cut their budget in order to avoid a loss in competitiveness. As Rodrik (1997a) describes: *"[...] the integration of markets for goods, services, and capital is pressuring societies to alter their traditional*

practices, and in return broad segments of these societies are putting up a fight. These pressures for change are tangible and affect all societies. [...] Ask business executives or government officials why these changes are necessary, and you will hear the same mantra repeatedly: 'We need to remain (or become) competitive in a global economy' " (p. 1-2).

Whether globalization causes big or small governments cannot be answered unambiguously (this will become more evident in Section 1.2). But probably everyone agrees that the public sector faces great challenges caused by market integration and that globalization affects government behavior. It is beyond the scope of this book to shed light on all the dimensions of the interrelation between globalization and public spending. The main globalization channel that this study focuses on is trade liberalization of intraindustry trade. Only one part of Chapter 4 is dedicated to capital market integration. The contribution of this book is to describe some new theoretical channels through which globalization affects public spending and to analyze them empirically. Thereby I distinguish between the real and the nominal government share. On the one hand, a new channel is identified of how the real government share reacts to globalization. On the other hand, beyond its impact on the real share, it is shown that market integration can have important additional effects on the nominal government share.

This introductory chapter is structured as follows. Section 1.1 describes some stylized facts of the public sector. Section 1.2 presents the literature on the interdependence between openness and government size. First, some theoretical channels of how capital markets' and goods markets' integration may affect public goods provision are discussed. Then, the existing empirical evidence about this relationship is reviewed. As trade liberalization will be the main globalization channel discussed in this book, Section 1.3 briefly describes the background and key features of the 'New Trade Theory' literature. Finally, Section 1.4 sketches the basic idea of Chapters 2, 3 and 4 and points out their contribution and how they are related to the existing literature.

1.1 Public Sector: Stylized Facts

1.1.1 Growth of Government Spending

Public spending has risen enormously in many countries during the last century. The steady growth of government shares has been already addressed by Wagner in the late nineteenth century as he noticed increasing government spending on infrastructure, education, and health care.[1] Despite the change to the modern welfare state in the nineteenth century, the growth of government shares was comparably moderate until the World War I.[2] Tanzi and Schuknecht (2000) write that the unweighted average of public expenditure as a share of GDP for 17 industrialized countries was approximately 11 percent of gross domestic product in 1870. The first World War induced an increase in government spending from approximately 13 (in 1913) to 19 (in 1920) percent of gross domestic product. The great Depression, starting in 1929, was interpreted as a failure of the market economy which resulted in more active governments and higher government expenditures. In 1937, the average share of government spending was about 23 percent. After the World War II, it continued to grow as governments took over an even more active role in the economy. *"The development of the theory of public goods and of the concept of externality suggested a growing allocative role for the state"* (ibid. p. 10). The redistributive role of the government became a more important one. Beside social spending, the focus were also put on expenditures on education, health and infrastructure.[3] This growth in government spending continued to increase until 1980 where it reached on average 43 percent (ibid.). The rising costs of government and the failure to allocate resources efficiently and to stabilize the economy in the recession of the 1970s, led to a growing skepticism about government intervention (ibid.). Finally, in the early 1980s, the growth has slowed down and for some countries public expenditure shares even declined. *"[...] [W]hat started as a policy to cope with growing budget deficits and cure rampant inflation during the 1980s developed into a campaign to [...]roll back the State[...]"* (UN, 2001, World Public Sector Report, p. 34).

[1] Musgrave et al. (1975).

[2] For early numbers on government spending components for Germany, United Kingdom and Sweden see Flora and Heidenheimer (1981) and Nowotny (1999).

[3] Nowotny (1999).

Figure 1.1 shows the development of the unweighted mean of real (constant 2005 prices) and nominal (current prices) government consumption as a share of GDP from 1950 to 2007 (derived from Penn World Tables 6.3).[4] Government consumption does not include public investments and income transfers. This explains the lower level of government spending compared to the aforementioned figures. There is an obvious increase in nominal terms for both OECD and non-OECD countries until 1980 after which it flattened and finally in the 1990s started to decrease. It was in the 1990s when Great Britain and USA have declared the end of 'big government'.[5] The evolution in real terms is quite similar compared to the one in nominal terms, except in the early years of the OECD sample. The real share declined for more than a decade, from the late 1950s to 1970, while in nominal terms there has been a steady increase.

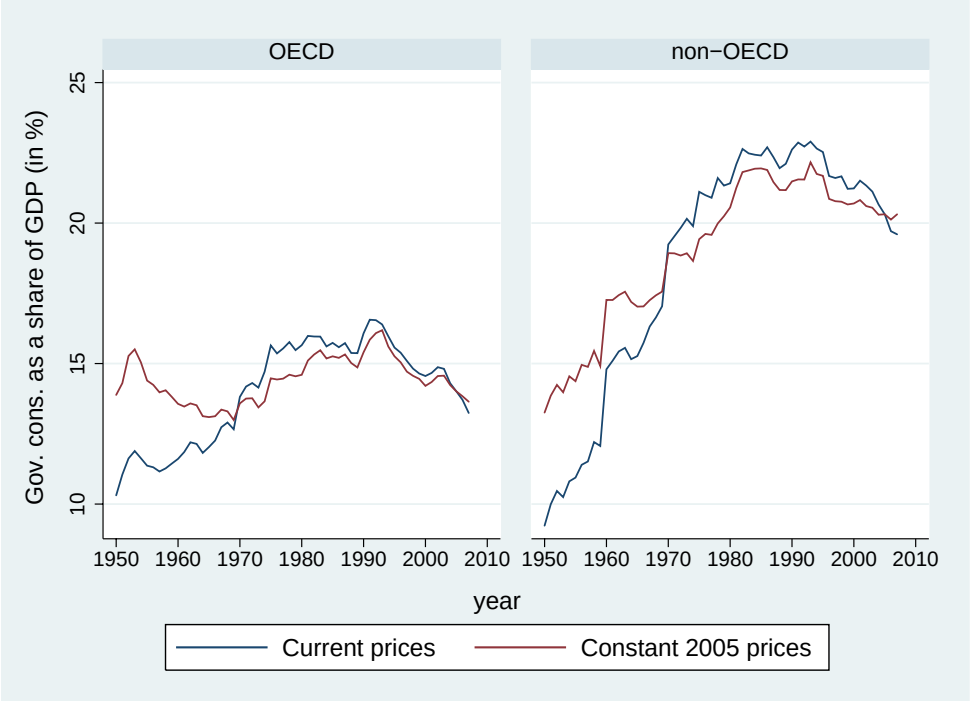
Tanzi and Schuknecht (2000) emphasizes that the most rapid growth in government expenditure has taken place between 1960 and 1980. Many research scholars in the 1960s and 1970s were concerned with the steady growth of the public sector which did not seem to change in the foreseeable future. This makes it not at all surprising that studies about public sector growth exist en masse and with it theories and explanations. For a long time only domestic causes have been identified as sources for public sector growth (see e.g., Garrett and Rhine (2006) for an overview). Finally, the question arose how and whether globalization can be made responsible for this boom to some degree. Observing that after the second World War economies have become increasingly integrated, Rodrik, 1997b notices: *"Economists have paid surprisingly little attention to the relationship between [...] the growth of government, on the one hand, and the intensification of international economic integration, on the other"* (p.2).

How government spending might be related to market integration - theoretically and empirically - is discussed in the literature review in Section 1.2.

[4]Government consumption from an earlier version of the Penn World Tables (PWT 6.2) will be an important measure in the empirical part of this book.

[5]As US President William J. Clinton said in his address about the state of the Union, at January 23, 1996: *"We know big government does not have all the answers. We know there's not a program for every problem. [...] The era of big government is over."*

Figure 1.1: Development of government consumption in OECD and non-OECD from 1950-2007 (unweighted average)



Source: PWT 6.3, own calculations

1.1.2 Home Bias and Labor Intensity

It is often assumed in many of the reviewed articles in Section 1.2 and also in this book that the public sector produces non-tradable goods or/and consumes only domestic goods. This seems to be a strong assumption. However, it is widely accepted among scholars that the home bias in public consumption is quite large. Table 1.1 provides some numbers on the share of imports of government consumption. Indeed, the average share of imports in government consumption of the selected countries amounts to only 1 percent confirming the impressively strong home bias in government consumption.

Also, it is often assumed that the public sector is more labor intensive than the private sector as it is more intensive in services. According to Monacelli and Perotti (2008), the average share of services in total spending on goods and services in the U.S. for the period 1954 to 2006 amounts to 0.49 for private consumption and 0.80 for public spending (including wages for public employees). The figures are reproduced in table 1.2.

Non-tradability of public goods is going to be a central assumption in the models

Table 1.1: Home Bias in Government Consumption

	Government Import (% of Gov. Consumption)	Total Import (% of GDP)
Brazil	1.07	10.75
Canada	0.03	45.20
Czech Republic	1.78	64.17
Denmark	0.00	38.84
Finland	1.64	39.16
Germany	0.80	32.03
Hungary	1.67	53.94
Indonesia	3.38	30.56
Ireland	3.66	93.82
Netherlands	0.11	63.05
Slovak Republic	0.22	73.09
Sweden	0.02	48.13
Switzerland	0.04	44.70
United Kingdom	0.10	28.62
Mean	1.04	47.58

Source: Epifani and Gancia (2009, Table A1), calculated from OECD Input-Output Tables around the year 2000

Table 1.2: Average shares of spending on goods and services in the US, 1954:1-2006:2

	Private	Government
Spending on goods in GDP	0.32	0.035
Spending on services in GDP	0.32	0.14
Services in total spending on goods and services	0.49	0.80

Source: Monacelli and Perotti (2008, Table 1), calculated from NIPA accounts

discussed in this book. The labor intensity in public spending will only be an important assumption in Chapter 4. Even there, the assumption is only crucial for a part of the results. Although, the channel described in Chapter 2 does not require that the public sector is more labor intensive, the framework allows for differences in labor intensity between the two sectors.

1.1.3 Baumol's Cost Disease

A big concern in the 1960s and 1970s has been steady growth of the public sector in nominal terms relative to real output (see figure 1.1). According to Baumol (1967) one

explanation might be as follows. If the price of public goods increases and demand for public goods is price inelastic (i.e., does not decrease proportionately), government spending increases.[6] The price of the public good relative to the private goods prices may increase because productivity in the private sector increases more than in the public sector. If labor is mobile between the two sectors, wages in all sectors increase and the costs in the public sector increase relatively more. The rising expenditure shares for public goods is well known by the term Baumol's cost disease.

This difference in productivity growth between the private and public sector is based on the observation that the public sector is relative service intensive.[7][8] Mueller (2003) ascertains that there exist some studies which suggest that government productivity lags private sector productivity and may be even zero or negative. Empirical evidence for Baumol's cost disease in the public sector is provided, e.g., in Spann (1977), Berry and Lowery (1984), Ferris and West (1996), Mueller (2003). Ferris and West (1996) find that slower productivity in the public sector accounts for two-thirds of the rise in the cost of U.S. government services between 1959 and 1989. Mueller (2003) finds that for probably all 25 investigated OECD countries the Baumol effect explains at least a part of the increase in government expenditures from 1960 through 1995.

1.2 Openness and Government Size: Literature Review

1.2.1 Theory

It is commonly assumed that the growing mobility of capital puts pressure on capital taxation and as a consequence on government spending. As Wilson (1999) states: *"A central message of the tax competition literature [(e.g., Zodrow and Mieszkowski, 1986; Wilson, 1986; Wildasin, 1988; Bucovetsky, 1991)] is that independent governments en-*

[6]Note that the price of public goods is equal to the costs.

[7]Beyond doubt, some components in government spending are quite capital intensive such as military service and may also experience large productivity increases.

[8]Note that the argument of lower productivity growth in the labor-intensive public sector compared to the capital-intensive sector is also underlying the Balassa-Samuelson effect in international macroeconomics.

gage in wasteful competition for scarce capital through reduction in tax rates and public expenditure levels." If in one region a tax is levied on mobile capital, a part of this tax base will move to a region where net returns are higher. Hence, imposing a tax rate in one region has a positive externality for the other region. A general result of this literature is that optimal taxation of mobile capital results in inefficiently low tax rates and a smaller public sector.[9] In order to overcome the problem of underprovision of public goods due to low tax rates, governments should cooperate which results in efficiency gains.

While this mechanism has been mainly discussed in the context of capital mobility, it is clearly also at work when goods markets integrate (see Haufler, 2001). High tax rates on commodities in region A make the commodities more expensive in A. It follows that some customers will consume in country B. This positive externality will again lead to inefficiently low tax rates in a non-coordinated Nash equilibrium (Haufler, pp. 31-32). As a consequence, a negative relationship between trade liberalization and government size is to be expected.

In view of the channels discussed so far, globalization and increasing competition in the international goods market constrain government activity. International integration calls for smaller governments as tax distortions should be reduced to maintain competitiveness (Andersen, 2002). The literature sometimes denotes this type of negative relationship the 'efficiency hypothesis'. Garrett (2001) explains: *"The fundamental tenet of the efficiency hypothesis is that government spending [...] reduces the competitiveness of national producers in international goods and service markets. [...] Income transfer programs and social services distort labor markets and bias intertemporal investment decisions. Moreover, government spending must be funded, often by borrowing in the short-term, and ultimately by higher taxes."* For instance, Alesina and Perotti (1997) show that an increase in transfers raises unit costs of tradable goods (i.e., generates a loss in competitiveness), lowers demand for exports and decreases domestic employment.

Interestingly, although it seems intuitively plausible that government activity comes under pressure if markets are highly integrated, theories predicting exactly the opposite effect are not rare. For instance, Baldwin and Krugman (2004) show that economic in-

[9] If one looks at countries with different size (e.g., Bucovetsky, 1991; Wilson, 1991) it follows that small countries face a more elastic tax base (an increase in the tax rate leads to a larger capital outflow in per capita terms). It follows that small countries set a lower tax rate.

tegration can lead to a race to the top rather than a race to the bottom. Based on a standard tax competition model, the authors take into account that industrial concentration in the core (industrialized countries) creates an 'agglomeration rent'. If there are significant agglomeration effects, firms know that they can earn more in the core than in the periphery (less industrialized countries). Hence, core governments can tax their industries more than a periphery government without losing capital. On top of that, Baldwin and Krugman (2004) find that tax harmonization may harm both industrialized and less industrialized nations.[10]

Another explanation for a positive relationship between trade openness and government size is pointed out by Cameron (1978) and Rodrik (1998). The underlying story in both arguments is that international market integration comes at the costs of greater risks. The government is assumed to provide insurance against these risks and transfers to compensate for the losses. The literature has named this explanation as the 'compensation hypothesis'. Rodrik illustrates his argument with a simple model. He assumes that the terms of trade (price of the export relative to the import good) is stochastic which pictures the idea of trade related risks.[11] Imports are intermediate goods and are assumed to increase productivity of domestic private production. This assumption makes domestic production depend on the terms of trade risk. The public good is produced with domestic labor so that the public sector is not exposed to the terms of trade risk. The government, when determining the optimal size of the public sector, follows the *"standard portfolio arguments [which] suggest that an increase in the riskiness of exports calls for a reallocation of the economy's resources toward the safe activity (government) [...]"* (Rodrik, 1998, p. 1014).

The standard tax competition result, that governments in open economies face additional costs in terms of outflow of mobile factors if they are taxed heavily is one side of the coin. However, market integration may also bring opportunities and benefits which make it possible to levy a part of the domestic tax burden on foreign countries. This is the case if the externality on the foreign country is negative. One such channel which is well known

[10]Note that these results of Baldwin and Krugman (2004) are only valid if there is only one core country (i.e. no competition within the core).

[11]Already Bates et al. (1991) indicate that governments may respond to risks generated by fluctuations in international market prices.

in the literature is the terms of trade effect. Epifani and Gancia (2009) have elaborated the terms of trade effect in an Armington (1969) framework with one homogeneous good produced under perfect competition in each private industry and product differentiation by countries. Under the assumption that governments spend their income on domestically produced goods, whereas households spend a fraction of income on imports as well, higher government spending increases demand for domestic labor. As long as domestic and foreign goods are imperfect substitutes the increase in demand for domestic labor has a positive effect on wages and prices which leads to a terms of trade improvement. The elasticity of substitution between the different country specific goods determine the degree of the terms of trade externality. A low substitutability implies a strong terms of trade externality and a relatively high level of optimal public good provision. Moreover, an increase in the fraction of tradable industries leads to higher government spending because the terms of trade externality can play in more industries. Therefore, trade liberalization leads to larger public sectors when changes in public spending influence the terms of trade. Taking into account the terms of trade effect, non-cooperative fiscal policies may be too expansionary. Hence, unilateral decisions on optimal public good provision results in overprovision compared to what would be welfare optimal from an aggregate point of view. Coordination between the two governments leads to higher aggregate welfare. This channel is analyzed by van der Ploeg (1987), Turnovsky (1988), Chari and Kehoe (1990), Devereux (1991), Persson and Tabellini (1992) and Anderson et al. (1996) and Epifani and Gancia (2009).[12]

To sum up, different channels play together in the interaction of the public sector with international markets. Globalization can lead to small or large governments. The magnitude of the different effects and thus the overall effect of globalization on government size can only be determined empirically. A general result from the theoretical literature is that globalization increases the chances that individual policy decisions affect other regions and countries positively or negatively resulting in under- or overprovision of public goods. In either way, one important conclusion is that globalization requires international coordination.[13]

[12]Anderson (2006) points out that the inefficiencies by non-cooperative policies increase with a reduction of trade costs and hence, the gains from coordination will increase with market integration.

[13]Many of the problems affecting the world today cannot be solved on national level and requires

1.2.2 Empirical Evidence

As different theories exists, the one pointing to a negative and others to a positive relationship between globalization and government size, an important question is: What do the data say? Political scientists, for example, Cameron (1978) and Katzenstein (1985) were among the first who have noticed a positive relationship between international trade and the size of government. Cameron (1978) finds in a cross-section of 18 OECD countries that the increase in government revenues as a percent of GDP averaged over 1960 to 1975 is positively associated with trade openness (the sum of exports and imports relative to GDP) in 1960.[14] Cameron argues that small open countries have a higher degree of industrial concentration which facilitates the formation of labor confederations, fosters higher unionization and increases the scope of collective bargaining. This results in a higher demand for government transfers which attenuate the external risks. The argument that the government takes on the role of providing insurance against external risk, has later been taken up by Rodrik (1997a,b, 1998). Rodrik (1998) comments that Cameron's source of external risk is not plausible for most developing countries. Moreover, he finds that not only government transfers but also government consumption is positively correlated with trade openness. Therefore, he argues that a different source of external risk must be at work. Rodrik considers two measures of external risk, volatility of terms of trade and - to compare it with Cameron's argument - product concentration of exports. He finds strong indication that the main channel works through the terms of trade risk.[15] Rodrik (1998) finds empirical support for the following hypotheses: *"First, increases in external risk must lead to greater volatility in domestic income and consumption. Second, a larger share in GDP of government purchases of goods and services must reduce income volatility. Third, the risk-mitigating role of government spending should be displayed most prominently in social security and welfare spending [...]"* (p. 998).[16] Rodrik's analysis is mostly cross-section of approximately 100 countries for several years. If government

international norm-setting and regulations (UN, 2001, World Public Sector Report).

[14] In the following trade openness denotes exports plus imports divided through GDP.

[15] The interaction term of openness with either measure of external risk has a positive effect on public consumption. However, there is a high correlation between the two interaction terms, and a regression with both interactions as regressors shows that terms of trade risk does all the work of explaining the positive correlation.

[16] Empirical evidence that a larger government size is associated with lower output volatility is provided, e.g., by Fatás and Mihov (2001).

spending is averaged over the period 1990-1992 (1985-1989), trade openness is averaged over the period 1980-1989 (1975-1984). His panel estimation for the period 1960 to 1992 does also support his hypotheses.

Rodrik's work has initiated a number of empirical studies trying to confirm or confute the positive relationship between trade openness and government spending. In a cross-section of 113 countries for 1985-1995 averages, Garrett (2001) confirms the positive significant effect of trade openness on government consumption. Alesina and Wacziarg (1998) argue - based on cross-section data of 1985-1989 averages and 122 countries - that the positive relationship between openness and government size documented by Rodrik (1998) may be driven by the negative relation of country size with both trade openness and the share of public consumption in GDP.[17] Alesina and Wacziarg argue that large countries can better rely on themselves and can afford to be closed. Additionally, because of economies of scale and non-rivalry in public good provision, small countries may have a larger government share in GDP. This finding has been revisited by Ram (2009). In a large panel data set of 154 countries from 1960 to 2000 he finds no such relationship when controlling for country fixed effects. Population which is used as a proxy for country size is positively correlated with both government size and openness. Most importantly, trade openness has - despite controlling for country size - a positive effect on government consumption share.

Different studies have challenged the question of causality. Does really openness affect government spending or does government spending influence the degree of openness of a country?[18] Rodrik (1998) executes some robustness checks by employing several instruments for trade openness. Some studies approach the endogeneity issue with a test for Granger causality. For instance, using time series data for 23 OECD countries over the period 1948 to 1998, Molana et al. (2004) find only for a few countries in the sample a causal positive relationship from trade openness to government consumption as a share of

[17] Additionally, they argue that the association between government spending and openness disappears if the ratios are not taken in logs. This is also found in Garen and Trask (2005).

[18] As an example, government policies determine the degree of tariff rates and non-tariff barriers which reduces trade flows. One may also argue that government expansion may crowd out private production and exports, reducing the volume of trade. Or, countries with a large public sector would prefer to be more open.

GDP.[19] In a more recent study, Benarroch and Pandey (2008) provide a Granger causality test based on a large panel data set (96 countries over the time period 1970-2000) which does not support Rodrik's finding. They rather find a causal negative relationship from government size to trade openness.

The 'openness government size' nexus has been differently approached by Garen and Trask (2005). Most of the literature discussed above focuses on expenditure based measures of government. Garen and Trask demonstrate that the scope of governments is much larger in less open economies when non-budgetary measures are considered. In a cross section of 92 countries for the year 1990, they find that measures such as government ownership of enterprises, price controls and asset expropriation are negatively affected by trade openness (export plus import relative to GDP) and positively correlated with trade barriers.

The aforementioned literature mainly analyzes the effect of trade openness on the size of the public sector. A broader investigation of some channels discussed in Section 1.2.1 is provided for example in Garrett and Mitchell (2001). They concentrate their empirical analysis on OECD countries for the time period 1961 to 1993. To validate the two competing hypotheses 'efficiency' versus 'compensation',[20] they do not restrict their analysis on total trade flows but also analyze globalization measures such as FDI and financial market integration. The authors *"found some evidence of globalization-constraints on government spending"* (ibid. p. 174). Trade openness has a negative effect on both government consumption and income transfers. However, *"the evidence on capital taxation was more supportive of the compensation perspective"* (ibid.). Foreign direct investment is associated with higher capital tax rates and other measures for financial market liberalization have no impact on capital taxation.

Also Baldwin and Krugman (2004) illustrate that the average corporate tax rate (i.e., corporate tax revenue as a share of GDP) did not decrease at all between 1965 and 2000 in some European countries. Quinn (1997) finds some evidence that the degree

[19] Another time series analysis has been conducted by Islam (2004) who finds a positive link between trade openness and government expenditure as a share of GDP for the countries Canada, England, Norway and Sweden but a negative relation for USA.

[20] The efficiency hypothesis summarizes channels which leads to lower government spending. Under the compensation hypothesis, we expect a positive relationship between openness and government spending as governments compensate for external risks. See the discussion in Section 1.2.1.

of capital account liberalization is positively associated with government expenditures (net of defense and education) for a cross-section analysis (averages from 1974 to 1989) of 38 countries and also positively correlated with most corporate taxation indicators. However, Garrett (2001) could not confirm this finding in a 113 country cross-section for 1985-1995 averages. Capital account regulation does not significantly affect central government spending and government consumption.

In a panel analysis from 1967 to 1996 for 14 OECD countries, Bretschger and Hettich (2002) find evidence that trade openness and capital market liberalization have a positive effect on social expenditure (as a share of GDP). This finding supports the compensation hypothesis. Moreover, consistent with the standard tax competition argument, corporate taxes are negatively associated with globalization. The authors argue that their different findings in support of the tax competition argument lie in the more appropriate measure for corporate taxation.

Most empirical literature has focused on the loss of competitiveness argument versus Rodrik's risk compensation hypothesis. Whether government size is positively associated with trade openness due to the terms of trade externality has only been investigated in Epifani and Gancia (2009).[21] They provide a direct test of the terms of trade externality versus Rodrik's compensation hypothesis. For the cross-section analysis, they have data of 143 countries and the years 1995-2000. The panel analysis covers the years 1950 to 2000. Since the terms of trade externality works only if the domestic and foreign goods are imperfect substitutes, Epifani and Gancia (2009) use the inverse of the elasticity of substitution to capture this effect. The authors provide empirical evidence for their argument in both cross-section and panel data analysis while Rodrik's finding is not confirmed. The authors find that trade openness has a stronger positive effect on the government consumption share when the elasticity of substitution is low.

One thing stands out while reviewing the existent literature and the discussion about how trade openness affects public spending. New Trade Theory models exist now for three decades and with it the comprehension that gains from trade due to import of new varieties play an important role in consumption and production. Nonetheless, the

[21] Empirical evidence that government spending generates an appreciation of the terms of trade (price of exports relative to imports) and an increase in the price of non-traded versus traded goods is provided, for instance, by Monacelli and Perotti (2008) and Müller (2004).

theoretical and empirical discussion 'how trade openness affects government size' has not been extended to this new insights. The main contribution of this book is to fix this hole and to add to the existing literature new insights into the discussion 'how trade openness affects government size' which arise by taking New Trade Theory into account.[22] Some important features of the New Trade Theory literature are described in the following section.

1.3 New Trade Theory

Around three decades ago Krugman (1979, 1980) provided a simple theoretical framework where consumers gain from trade through the import of new varieties. More importantly, Krugman's framework could explain a predominant feature of the observed pattern of trade which is the high degree of intra-industry trade between industrialized countries. Central elements of this seminal work is that there is monopolistic competition with endogenous firm entry and that the consumption basket combines all available varieties according to a Dixit-Stiglitz aggregator. The finite elasticity of substitution between the varieties implies that there is a 'love of variety' (LOV), i.e., utility increases proportionally more if the range of varieties increases than if consumption of a given variety increases. Because of LOV, there are gains from trade through the import of new varieties. Ethier (1982) adopted this approach to a model in which final output is produced with intermediate goods. The intermediate goods are produced under monopolistic competition. The homogeneous output good is produced with a combination of all available intermediate goods according to a Dixit-Stiglitz aggregator. Because of the finite elasticity of substitution between the intermediate inputs, there are gains from trade in production (external economies of scale) through the import of new varieties. Whether the focus is on intermediate or output goods trade, gains from variety should appear on both levels.

There is evidence that gains from trade due to imports of new varieties are empirically relevant. Broda and Weinstein (2006, 2004) find that imports of new varieties have brought welfare gains to the United States and several other countries via a reduction in

[22]The tax competition literature has been extended to the New Trade Theory framework, see e.g., Janeba (1998), Baldwin and Krugman (2004) and Davies and Eckel (2010).

the consumer price index. Broda et al. (2006) provide evidence for productivity gains due to new imported varieties in several countries.

What makes Krugman's framework so tractable is that all firms have identical technologies but still no one produces the same variety because of economies of scale. A consequence of this simplification is the disadvantage that none or all goods are traded. However, firms are different and the data shows that only a few firms export within industries. These exporting firms are bigger and more productive. Taking firm heterogeneity into account (firms differ in their level of productivity), Melitz (2003) provides a model which produces a lot of the observed patterns in the data. Because of trade costs, only the most productive firms can export. In this setting, trade liberalization produces firm exit and entry in the domestic market such that the least productive firms exit the domestic market. As a result average or aggregate productivity of the producing firms increase. The underlying intuition behind this process can be summarized as follows. Trade liberalization increases profits in the export market which induces more firm entry. The increased labor demand raises the real wage and forces the least productive firms to exit.

We will see that by enriching the existing discussion on the link between openness and government size with some central elements of New Trade Theory, a lot of interesting and new insights can be obtained.

1.4 Outline

The remainder of this book has the following structure. The second chapter focuses on the theoretical analysis of the impact of globalization on government size when intraindustry trade and gains from variety are important elements of international integration. The set up for determining government size is related to the literature on optimal public good provision which considers strategic interactions between two governments.[23] Differences in country size and in technology allow to answer the question how asymmetry between countries matters. The contribution of this chapter is to account for monopolistic competition with endogenous firm entry and love of variety. In this setting, costs of public good provision are the crowding out of domestic firms and varieties. When goods markets are

[23]This model draws on Hanslin (2008).

integrated, it is straightforward that the crowding out of domestic firms will also harm consumers in the foreign country as their range of different imported goods decrease. Unilateral decisions on optimal public good provision results in overprovision of the public good as the negative externality on foreign is not taken into account by the domestic government. Trade liberalization is related to larger government size. Moreover, country size matters. As the small country can more rely on the varieties from the large one, the small country will choose a higher government share than the large country. To prevent this beggar-thy-neighbor behavior and to maximize aggregate welfare, policy coordination is required.

Chapter 3 focuses on the empirical analysis. For this purpose, a simple version of the model described in the second chapter is formulated from which some hypotheses are derived which are analyzed empirically.[24] We will see - in line with Chapter 2 - that gains from variety play an important role in determining the size of the public sector also empirically. The main contribution to the literature is to provide empirical evidence for the main story in Chapter 2 - the love of variety effect on government spending. In order to test this channel, the measure for openness to trade is the extensive margin of imports. This measure allows to match the gains from trade to the gains from variety.

Chapter 4 focuses on the question of how globalization affects the nominal size of government spending apart from the effects on public expenditures measured in real terms. The model in Chapter 4 differs from most literature discussed in Section 1.2.1 as it is not optimal public good provision which this chapter looks at.[25] Rather, the question is: how does capital market integration and trade liberalization affect the ratio between the nominal and real government size? Looking at the ratio between the two measures of government size is the same as considering the price of governments (unit costs) relative to the private sector price. Hence, the chapter is closely related to the literature which explains differences in prices between tradable and non-tradable sectors. It is well known from this literature that countries which are more capital-rich and countries with higher productivity growth in the tradable sector show higher prices in non-tradable than tradable sectors (see Bhagwati, 1984; Gemmell, 1987; Balassa, 1964; Samuelson, 1964).

[24] Note that this chapter follows Hanslin (2010).

[25] This chapter is based on joint work with Josef Falkinger (Falkinger and Hanslin, 2010).

The chapter contributes to this literature as it explains relative changes in prices between the government and the private sector with capital market integration and trade liberalization. Capital market integration may affect the relative prices when the public sector produces more labor intensive. Trade liberalization can affect productivity positively in the private sector (as discussed in the previous section) which in turn explains changes in the relative prices. It follows that trade liberalization (through its effect over productivity) can be responsible for a Baumol's cost disease (Baumol, 1967). The hypotheses are also going to be investigated empirically for a large panel data set and separately for OECD countries.

It is important to emphasize that each chapter should be considered as an independent unit concerning the notation. Each of the following chapters ends with a conclusion. The summary in Chapter 5 recapitulates the main insights of this book and provides a brief outlook.

2

The Effect of Trade Liberalization on Optimal Government Size

Beyond doubt, one of the great findings in trade theory was the insight that access to international varieties is an important source for gains from trade (Dixit and Stiglitz, 1977 and Krugman, 1979, 1980). Intraindustry trade and endogenous firm entry have dominated the trade literature in the last few decades, both theoretically and empirically. Surprisingly, despite the dominance of gains from variety in the new trade theory, this aspect has not been taken up in the recent discussion about globalization and public spending following a seminal paper by Rodrik (1998). As pointed out in the introduction, many studies about fiscal policy in open economies concentrate on the effects of a public expansion on the terms of trade (e.g., van der Ploeg, 1987, Turnovsky, 1988, Devereux, 1991, Anderson et al., 1996, Anderson, 2006 and Epifani and Gancia, 2009).[1] These studies point out that the costs of taxation can be exported onto foreign countries since unilateral fiscal expansion leads to an improvement in the terms of trade. Therefore, governments react to market integration by increasing public spending.[2] This chapter ties in with the debate on the effects of trade openness on the size of the public sector by

[1] See also Persson and Tabellini (1995) for a survey.

[2] Rodrik's (1998) explanation for a positive correlation between openness to trade and government spending is different. He argues that openness may expose a country to greater risk, due to terms of trade volatility. In this case, there may be a need to extend government spending after trade liberalization in order to provide a social insurance against the external risk. Empirical evidence by Cameron (1978), Rodrik (1998), Garrett (2001) and Epifani and Gancia (2009) supports the positive relationship between openness to trade and public expenditure.

having a closer look at the implications from new trade theory for this debate.[3] Taking into account the important developments in the new trade theory - gains from variety and endogenous firm entry - this chapter provides us with a new explanation for the positive relationship between openness to trade and public expenditure.

The literature regarding the effect of public spending on firm entry in an international context mainly focuses on public spending for infrastructure (e.g., Holtz-Eakin and Lovely, 1996 and Egger and Falkinger, 2006). These papers point out that an increase in public spending makes a country more attractive and stimulates firm entry. In contrast, in this chapter it is assumed that public spending is used for the production of a public consumption good. Thus, government activity affects only the available resources for the private sector, which has quite different implications for the number of firms.

Accounting for endogenous firm entry, this chapter identifies the negative effect of the public sector on the number of firms as an important cost of public good provision.[4] An increase in public production lowers domestic employment in the private sector and the number of domestic firms producing a variety. However, in integrated markets, domestic consumers have also access to foreign varieties. Therefore, in open economies, government expansion reduces the number of varieties available to consumers relatively less than in closed ones. Thus, the national costs of public good provision are lower, the more a country is integrated into the world market. This provides important new insights why trade liberalization may lead to bigger governments.

The effect of trade liberalization on the optimal government size is analyzed within a general equilibrium framework with two possibly asymmetric countries. The countries may differ in total factor productivity, capital and labor endowment and fixed cost technology. In both countries there is a private and a public sector, both producing consumption goods with capital and labor. The private sector is characterized by a continuum of industries of measure one, supplying tradable and non-tradable goods under monopolistic competition. The country-specific public good is assumed to be non-tradable. The measure for openness to trade is obtained by assuming that an exogenous fraction of private

[3]This chapter is based on Hanslin (2008).

[4]Generally, a crowding out of the private sector due to an expansion of the public sector can occur at either the extensive or the intensive margin. The terms of trade effect described above may be illustrated by the latter, which is a reduction of the amount produced by domestic firms.

industries is tradable.[5] Trade liberalization is modeled as the opening up of industries. The advantage of this measure is to discuss the effects of a marginal increase of openness on public expenditure - rather than to make only a comparison between autarky and open economy. The way of modeling trade liberalization deviates from the standard with variable trade costs. The reason is that in order to describe the love of variety effect it is important to focus on gains from trade due to new varieties and not due to lower international market prices.[6]

The chapter is organized as follows. In the next section the theoretical model is introduced. Section 2.2 derives the equilibrium values of the variables for a given government share. Following the tax competition literature, in Section 2.3 benevolent governments in both countries choose their optimal government share. The Nash equilibrium of the public sector is analyzed with respect to the asymmetry between the two countries and the parameters of the economy. Section 2.4 further extends the discussion by analyzing the importance of the love of variety effect versus the market power effect. Furthermore, changes in the relative capital intensity between the public and private sector are addressed. Section 2.5 concludes. All proves and derivations are presented in Appendix A and some further interesting details are discussed in Appendix B.

2.1 The Model

There are two countries, home (H) and foreign (F). In both countries there is a private and a public sector. The private sector is characterized by a continuum of industries of measure 1 indexed by $j \in [0, 1]$. In each industry and country various firms produce differentiated goods with capital and labor under monopolistic competition. Each firm is monopolist for one variety, after having incurred some fixed cost. There is free entry, that is, the equilibrium number of firms in an industry is endogenously determined. Free trade is assumed between the two countries in an exogenous fraction $\tau \in [0, 1]$ of the industries and no trade for the remaining fraction $1 - \tau$. Without loss of generality industries with index $j \leq \tau$ are the trading industries and industries with index $j > \tau$ are the non-trading

[5] This way of modeling openness is taken from Epifani and Gancia (2009).

[6] Anderson (2006) provides an analysis of the effect of lowering trade costs on the terms of trade and optimal public good provision.

ones. Thus, τ is the measure for openness, assuming that both countries are equally open. In each country, there is one non-tradable public good which is produced with capital and labor. The countries have an endowment $\bar{K}_i$ of capital and $\bar{L}_i$ of labor. Both production factors are perfectly mobile between sectors within each country. The subscript i refers to the two countries H and F.

2.1.1 Endowments, Preferences and Demand

The representative household owns total endowment of capital ($\bar{K}_i$) and labor ($\bar{L}_i$). Hence, the household's income is given by $w_i\bar{L}_i + r_i\bar{K}_i$, where w_i denotes the wage rate and r_i the factor price of capital in country i. Net income is given by $I_i := w_i\bar{L}_i + r_i\bar{K}_i - T_i$, where T_i denotes the tax imposed by the government.

The representative household derives utility from consumption of the different varieties in each industry and the country specific public good denoted by G_i.[7] The valuation for private goods versus the public good in the household's preferences is captured in the parameter $\eta \in (0,1)$.

$$U_i = \eta \int_0^1 \log Y_{ij} dj + (1-\eta)\log G_i \quad \text{for} \quad i = H, F \tag{2.1}$$

where subutility Y_{ij} is a CES aggregator over the varieties from industry j which are available in country i

$$Y_{ij} = \left(\int_{k \in \mathcal{N}_{ij}} \left(y_{kj}^i\right)^{\nu} dk \right)^{\frac{1}{\nu}}, \quad i = H, F \tag{2.2}$$

with $\nu \in (0,1)$.[8] y_{kj}^i denotes consumption of variety k from industry j by the representative household in country i.[9] The elasticity of substitution between any two varieties

[7] Appendix 2.7.3 discusses optimal public good provision if the public sector provides a variety of goods and households have a love of variety also for the public goods.

[8] Although it has become quite common in the literature to disentangle the degree of love of variety on the one hand and the elasticity of substitution and market power respectively on the other hand (e.g., Dixit and Stiglitz, 1975, Ethier, 1982, Benassy, 1996), for the tractability of the analysis the standard Dixit-Stiglitz assumption is used - with ν determining the degree of love of variety and market power simultaneously. For isolating the role of the love of variety, Section 2.4.1 provides an analysis using the Benassy (1996) assumption.

[9] The location of production does not matter for the household's optimal consumption choice since

from industry j is given by $\sigma = \frac{1}{1-\nu} > 1$. $\mathscr{N}_{ij}$ is the index set of all varieties from industry j which are available for consumption in country i. Within any industry $j > \tau$, the household consumes only the varieties produced in the own country, within an industry $j \leq \tau$, the household consumes all varieties produced in country H and F. Therefore, for $j \leq \tau$, $\mathscr{N}_{Hj} = \mathscr{N}_{Fj}$.

Since the elasticity of substitution between the subutilities Y_{ij} is equal to 1, the household allocates its expenditures equally among the industries. Moreover, since the measure of all industries is equal to 1, the amount allocated to an industry equals net income I_i. Thus, the budget constraint for purchasing varieties from an industry is given by the equation:

$$I_i = \int_{k \in \mathscr{N}_{ij}} p_{kj} y^i_{kj} dk \tag{2.3}$$

where p_{kj} is the price of variety k in industry j. In a traded industry the household spends the budget I_i on all industry specific varieties produced in country H and F, whereas in non-traded industries the household spends I_i only on domestic varieties.

Household's subutility (2.2) is maximized with respect to y^i_{kj}, subject to the budget constraint per industry (2.3). The resulting demand curve for each variety is given by

$$y^i_{kj} = \left(\frac{p_{kj}}{P_{ij}}\right)^{\frac{-1}{1-\nu}} Y_{ij} \ , \quad \forall \ k \in \mathscr{N}_{ij} \ , \ \forall \ j \in [0,1] \tag{2.4}$$

where $P_{ij} := \left(\int_{k \in \mathscr{N}_{ij}} (p_{kj})^{1-\sigma} \, dk\right)^{\frac{1}{1-\sigma}}$ is the consumer price index for industry j. It may be interpreted as the unit cost function of subutility Y_{ij}. Note that $P_{ij} Y_{ij} = I_i$.[10] Because of free trade, home and foreign have the same consumer price index in tradable industries: $P_{Hj} = P_{Fj}$ for $j \leq \tau$.

2.1.2 Production and Supply

2.1.2.1 Public Good

The country-specific public good is produced with capital and labor. Like firms the public sector takes factor prices as given, which is a common assumption in the literature. For

there are no trade costs.

[10] Use (2.4) in (2.3) for a check.

simplicity, it is assumed that the public good is produced with a Leontief production function:

$$G_i = \min\left\{\beta_i g_{Ki}\bar{K}_i, g_{Li}\bar{L}_i\right\} \tag{2.5}$$

where $\beta_i > 0$ describes the productivity of capital relative to labor in public good production and $g_{Ki} \in (0,1)$, $g_{Li} \in (0,1)$ the fraction of the economy's capital and labor endowments respectively, which are employed by the public sector. Cost minimizing production of the public good implies $\beta_i g_{Ki}\bar{K}_i = g_{Li}\bar{L}_i$. One advantage of the Leontief function in the public sector is the mathematical tractability of the model. Furthermore, it is sufficiently flexible to vary the degree of the labor intensity in the public relative to the private sector. Since I want to focus on the deprivation of resources through the public sector and the associated crowding out of the extensive margin of production (number of firms), it is assumed - throughout the main part of this chapter - that $\beta_i = \frac{\bar{L}_i}{\bar{K}_i}$. This implies that capital intensity in public good production is equal to the proportion of capital endowment to labor endowment in the country. Hence, under cost minimization $g_{Li} = g_{Ki} = g_i$ so that public production is given by $G_i = \beta_i g_i \bar{K}_i = g_i \bar{L}_i$ and government expenditures amount to $g_i(w_i\bar{L}_i + r_i\bar{K}_i)$. This assumption has the important virtue to isolate the crowding out of the extensive margin of private production from crowding out of the intensive margin (output per firm). This is necessary if we want to eliminate the terms of trade effect which would arise when the factor proportion supplied to the private sector is distorted by public production. Deviations from this assumption and the additional effects are discussed in Section 2.4.2.

The public good is financed by a lump-sum tax T_i. A balanced budget requires

$$T_i = g_i(w_i\bar{L}_i + r_i\bar{K}_i).$$

2.1.2.2 Private Goods

The production technology is identical for all firms and similar to Lawrence and Spiller (1983). Each firm in an industry produces one variety with labor according to

$$x_{kj} = A_i L_{kj} \tag{2.6}$$

where x_{kj} denotes output of firm k in industry j located in country H or F, L_{kj} is the input of labor of an individual firm and A_i denotes labor productivity in country i. Before starting with production a fixed amount of capital K_i^* has to be invested. Hence the fixed costs are given by the factor price of capital times overhead capital $r_i K_i^*$.[11]

Since trade is costless and firms face the same elasticity of demand in the domestic and foreign market, profit maximization implies a price equal to a constant markup over marginal cost

$$p_{kj} = p_i = \frac{w_i}{A_i \nu} \,, \tag{2.7}$$

which is independent of firm and industry.

Free firm entry implies zero profits in equilibrium. This determines the quantity produced by each firm x_{kj} which is identical for all firms within a country, independent of industry,

$$x_{kj} = x_i = \frac{A_i r_i K_i^* \nu}{w_i (1-\nu)} \tag{2.8}$$

and labor demand of each firm

$$L_i \left(\frac{r_i}{w_i} \right) = \frac{\nu}{1-\nu} \frac{r_i}{w_i} K_i^* . \tag{2.9}$$

2.1.3 Macroeconomic Equilibrium Conditions

2.1.3.1 Labor and Capital Market

Both capital and labor are used for production of private and public goods. Since the government employs $g_i \bar{K}_i$ and $g_i \bar{L}_i$ for public good production, $(1-g_i)\bar{K}_i$ and $(1-g_i)\bar{L}_i$ remains available for production of private goods. Further, each firm needs an amount of K_i^* to run the plant. The full employment conditions for capital and labor are

$$(1-g_i)\bar{K}_i = \int_0^1 n_{ij} dj K_i^* \tag{2.10}$$

$$(1-g_i)\bar{L}_i = \int_0^1 n_{ij} dj L_i \tag{2.11}$$

[11] One might assume a more general production function such as $x_{kj} = A_i (K_{kj} - K_i^*)^{1-\gamma} (L_{kj})^{\gamma}$, $K_{kj} \geq K_i^*$ which brings essentially the same results (see Hanslin, 2008). Therefore, I stick to the simpler version presented in the text.

where n_{ij} is the equilibrium diversity of private firms in industry j and country i which has to be determined endogenously.

2.1.3.2 Goods Market

Since goods prices depend only on the location of production (see (2.7)), we can drop the variety index and have the location index instead of the variety index. Therefore, from now on, consumption of a variety from industry j is denoted by $y_{ij}^{i'}$, $i, i' = H, F$, where i refers to the location of production and i' to location of consumption of the variety.[12] In a closed industry, consumption of a variety is equal to its production x_i. In an open industry, consumption of a variety is split between the two representative households:

$$x_i = \begin{cases} y_{ij}^{i} & \text{if} \quad j > \tau \\ y_{ij}^{i} + y_{ij}^{i'} & \text{if} \quad j \leq \tau \end{cases}, \quad i, i' = H, F \text{ and } i \neq i' \ . \tag{2.12}$$

For closed industries $j > \tau$, (2.12) together with $y_{ij}^{i} = \left(\frac{p_i}{P_{ij}}\right)^{\frac{-1}{1-\nu}} Y_{ij}$ and $Y_{ij} = \frac{I_i}{P_{ij}}$ implies that $P_{ij} = n_{ij}^{\frac{1}{1-\sigma}} p_i$ is identical across j. Thus, also $n_{ij} = n_i$ for all $j > \tau$. For open industries $j \leq \tau$ we have $P_{Hj} = P_{Fj} = P_j$. Thus $y_{ij}^{i'} = \left(\frac{p_i}{P_j}\right)^{\frac{-1}{1-\nu}} Y_{i'j}$ and $Y_{i'j} = \frac{I_{i'}}{P_j}$ which gives us for the demand of a traded variant: $y_{ij}^{i} + y_{ij}^{i'} = p_i^{\frac{-1}{1-\nu}} P_j^{\frac{\nu}{1-\nu}} (I_i + I_{i'})$. Combining this with (2.12) we see that P_j is identical across all traded industries. So we can write demand (2.4) in the form $y_i^{i'} = \left(\frac{p_i}{P_j}\right)^{\frac{-\nu}{1-\nu}} \frac{I_{i'}}{P_j}$ where only the distinction $j \leq \tau$ and $j > \tau$ matters for P_j. Keeping this facts in mind, we can drop index j if the context makes clear whether closed industries or open industries are discussed.

From now on I denote consumption of a variety in closed industries with x_H and x_F, respectively, and demand for varieties in open industries by y_k^i, $k = H, F$ and $i = H, F$, where k refers to the location of production and i to the location of consumption of the

[12] Note that we have $y_{ij}^{i'} = \left(\frac{p_i}{P_{i'j}}\right)^{\frac{-1}{1-\nu}} Y_{i'j}$.

variety. Consumption of a traded variety ($j \leq \tau$) can be written as:[13]

$$\begin{aligned}(y_H^H, y_F^H) &= \left(\frac{I_H x_H}{I_F + I_H}, \frac{I_H x_F}{I_F + I_H}\right) \\ (y_H^F, y_F^F) &= \left(\frac{I_F x_H}{I_F + I_H}, \frac{I_F x_F}{I_F + I_H}\right)\end{aligned} \tag{2.13}$$

Using the facts described above and the goods market clearing condition (2.12) for open industries gives us the following condition in equilibrium

$$\frac{x_H}{x_F} = \frac{y_H^H + y_H^F}{y_F^H + y_F^F} = \frac{(p_H)^{\frac{-1}{1-\nu}} P_j^{\frac{\nu}{1-\nu}} [I_H + I_F]}{(p_F)^{\frac{-1}{1-\nu}} P_j^{\frac{\nu}{1-\nu}} [I_H + I_F]} = \left(\frac{p_H}{p_F}\right)^{\frac{-1}{1-\nu}} . \tag{2.14}$$

2.1.3.3 Trade Account

Trade occurs because households love varieties. In open industries, a household spreads its consumption over all produced varieties in both countries. In equilibrium, the value of exports must equal the value of imports. In other words, the range of varieties times price times consumption of the varieties produced in country i and consumed in country i', integrated over all traded industries, must equal the diversity of varieties times price times consumption of the varieties produced in country i' and consumed in country i, integrated over all traded industries:

$$\int_0^\tau p_i y_i^{i'} n_{ij} dj = \int_0^\tau p_{i'} y_{i'}^i n_{i'j} dj \ . \tag{2.15}$$

2.2 Market Equilibrium and its Properties

The households spend an equal amount on each industry and prices and quantities produced are constant for all industries, $I_i = n_{ij} p_i x_i, \ j > \tau$. Therefore, in each non-traded industry an equal number of firms, $n_{ij} = \frac{I_{i'}}{p_i x_i}$, enters the market in equilibrium. In the tradable industries only the average diversity of firms per industry is determined. We may rewrite the trade account condition by using the budget constraint for purchases from a tradable industry, $I_i = n_{ij} p_i y_i^i + n_{i'j} p_{i'} y_{i'}^i$, taking the integral from 0 to τ on both

[13] See Appendix 2.6.1 for a derivation.

sides, and combining the result with (2.15). This yields $\tau I_i = \int_0^\tau n_{ij} p_i \left(y_i^i + y_i^{i'}\right) dj$. Since $y_i^i + y_i^{i'} = x_i$, this reduces to $\int_0^\tau n_{ij} dj = \frac{\tau I_i}{p_i x_i}$. Thus, the average number of firms in the tradable industries is equal to the number of firms in a closed industry. Since the total mass of industries is one, we get from (2.10)

$$\frac{1}{\tau}\int_0^\tau n_{ij} dj = n_{i,j>\tau} = n_i = \frac{(1-g_i)\bar{K}_i}{K_i^*} \,, \tag{2.16}$$

where $n_{i,j>\tau}$ denotes the range of firms in each non-tradable industry and n_i the range of firms per country.[14] The location of the firms in single tradable industries is undetermined. Interindustry trade allows that firms in one tradable industry are mainly located in H while in others are located more in F, as long as the location pattern is consistent with (2.16).

The higher capital endowment or the lower overhead capital required to run the plant, the higher is the measure of firms in equilibrium. The endowment left to the private sector is decisive for the measure of firms in the market. If the size of the public sector expands, fewer firms are active in the private sector. The negative effect of government spending on the number of firms originates from the fact that the public sector produces a consumption good. This may not be the case if the public sector produces infrastructure.[15]

The full employment conditions for labor (2.11) and capital (2.10) together with (2.9) determine the relative factor prices

$$\frac{r_i}{w_i} = \frac{1-\nu}{\nu}\frac{\bar{L}_i}{\bar{K}_i} \,. \tag{2.17}$$

Equation (2.17) implies that $\nu = \frac{w_i \bar{L}_i}{w_i \bar{L}_i + r_i \bar{K}_i}$. The share of labor income in total income is identical in the two economies. The lower the market power of firms (i.e., the higher ν), the higher is the wage share. Each firm producing a positive amount in equilibrium supplies (substituting (2.17) for w/r in (2.8))

$$x_i = A_i K_i^* \frac{\bar{L}_i}{\bar{K}_i} \,, \quad i = H, F \tag{2.18}$$

[14] Note that n_i describes also the number of firms in a closed industry.

[15] In Egger and Falkinger (2006) provision of public infrastructure lowers the fixed costs of entry which increases the number of firms.

and demands $L_i = K_i^* \frac{\bar{L}_i}{\bar{K}_i}$ of labor. The supply of each variety depends positively on the amount of overhead capital and productivity, and declines if capital supply is abundant relative to labor endowment. Note that only the factor proportion matters - not the absolute level of endowments. The assumption that the public sector does not distort the factor proportion implies that the size of the public sector does not affect equilibrium output per firm - in contrast to the diversity of firms.

For the numéraire I choose the price of home varieties. Setting $p_H = 1$, factor prices in home are determined by $w_H = \nu A_H$ and according to (2.17) $r_H = (1-\nu)A_H \frac{\bar{L}_H}{\bar{K}_H}$ respectively.

Condition (2.14) determines the price of foreign varieties in terms of the fundamentals of the economy:

$$p_F = \left(\frac{A_H}{A_F} \frac{\bar{L}_H \bar{K}_F}{\bar{K}_H \bar{L}_F} \frac{K_H^*}{K_F^*} \right)^{1-\nu} . \tag{2.19}$$

Note, since the price of domestic varieties is normalized, p_F is equal to the relative price of foreign to domestic varieties. The more productive and the less capital-rich is F relative to H, the lower is the relative price of foreign goods. Moreover, prices in foreign are low, ceteris paribus, if overhead capital is high in F. High overhead capital reduces the range of firms in F and increases output x_F per firm, which can only be sold if the price of the foreign varieties decreases as well. A low price requires that marginal cost is low. Through this channel high fixed capital requirements depress factor returns.

Equation (2.7) together with (2.17) determines the factor price of capital and wage rate in country F: $r_F = (1-\nu)A_F \frac{\bar{L}_F}{\bar{K}_F} p_F$ and $w_F = \nu A_F p_F$. Substituting p_F, we have

$$\begin{aligned} r_F &= (1-\nu) A_F^{\nu} A_H^{1-\nu} \left(\frac{K_H^*}{K_F^*} \right)^{1-\nu} \left(\frac{\bar{L}_H}{\bar{K}_H} \right)^{1-\nu} \left(\frac{\bar{L}_F}{\bar{K}_F} \right)^{\nu} \\ w_F &= \nu A_F^{\nu} A_H^{1-\nu} \left(\frac{K_H^*}{K_F^*} \right)^{1-\nu} \left(\frac{\bar{L}_H}{\bar{K}_H} \right)^{1-\nu} \left(\frac{\bar{K}_F}{\bar{L}_F} \right)^{1-\nu} \end{aligned}$$

Comparing this with H, we see that both factor returns are low if overhead capital in F is high relative to overhead capital in H. The net incomes are given by $(1-g_i)[w_i \bar{L}_i + r_i \bar{K}_i]$ which reduces to

$$I_i(g_i) = (1-g_i) A_i \bar{L}_i p_i \ .$$

To summarize, an increase in public spending (higher g_i) has only a variety effect - the equilibrium diversity of firms decreases. Supply of commodities and its prices, as well as the factor prices do not depend on the public good provision. This feature depends on the very special assumption of $\beta_i = \frac{\bar{L}_i}{\bar{K}_i}$ which implies that the capital intensity for public good production is equal to the capital intensity of country endowments. The factor prices depend on the relative factor availability for private production and as long as government does not affect this relative availability, government won't have an effect on market prices. Section 2.4.2 discusses the additional effects if $\beta_i \neq \frac{\bar{L}_i}{\bar{K}_i}$.

Since an increase in government spending crowds out private firms the next proposition follows directly.

Proposition 2.1. *An increase in the domestic government share (for given foreign government share g_F) reduces the volume of trade.*

Proof. See Appendix 2.6.4. □

Empirically there is a strong home bias in government consumption.[16] Hence, other things equal, an increase in government spending reduces the volume of trade. In the model the home bias is incorporated since the public good is produced with domestic labor and capital and is consumed only domestically.

2.3 Optimal Public Good Provision

2.3.1 Governments Optimization Problem

I assume a benevolent government whose aim is to provide a quantity of the public good that maximizes the utility of the representative household. Government's choice parameter is g_i, the fraction of capital and labor used for public good production. Having determined the equilibrium values in the last section we can describe the indirect subu-

[16] See for example Epifani and Gancia (2009).

tilities for traded and non-traded industries as follows:[17]

$$\begin{aligned} Y_{i,j>\tau}(g_i) &= (n_i(g_i))^{\frac{1}{\nu}} x_i \\ Y_{i,j\leq\tau}(g_i, g_{i'}) &= \left(\frac{I_i(g_i)+I_{i'}(g_{i'})}{I_i(g_i)}\right)^{\frac{1}{\nu}-1} (n_i(g_i))^{\frac{1}{\nu}} x_i \end{aligned} \tag{2.20}$$

where $i, i' = H, F$, $i \neq i'$. Note that $\left(\frac{I_i(g_i)+I_{i'}(g_{i'})}{I_i(g_i)}\right)^{\frac{1}{\nu}-1} > 1$. Since the household loves varieties, subutility in open industries is higher than in closed ones. Ceteris paribus, this difference is higher the poorer or smaller the country. It follows that richer or larger countries do gain less from trade than poorer or smaller countries.

Government in country i chooses g_i such as to maximize the utility of the representative household in country i taken as given $g_{i'}$ (government spending in the other country), where $i, i' = H, F$ and $i \neq i'$:

$$\max_{g_i} \quad \eta\tau \log Y_{i,j\leq\tau}(g_i, g_{i'}) + \eta(1-\tau) \log Y_{i,j>\tau}(g_i) + (1-\eta) \log G_i(g_i) \; . \tag{2.21}$$

Governments' maximization of the household's utility yields the following first order condition (see Appendix 2.6.1 for the derivation):

$$\vartheta_i := \underbrace{\eta\tau \frac{1-\nu}{\nu} \left(\frac{1}{1-g_i} - \frac{1}{1-g_i+(1-g_{i'})\Omega_{i'}} \right)}_{>0} \underbrace{- \frac{\eta}{\nu} \frac{1}{1-g_i}}_{<0} + \underbrace{(1-\eta)\frac{1}{g_i}}_{>0} = 0 \tag{2.22}$$

where I defined

$$\Omega_{i'} := \left(\frac{A_{i'}}{A_i}\right)^{\nu} \left(\frac{K_i^*}{K_{i'}^*}\right)^{1-\nu} \left(\frac{\bar{K}_{i'}}{\bar{K}_i}\right)^{1-\nu} \left(\frac{\bar{L}_{i'}}{\bar{L}_i}\right)^{\nu}$$

for $i, i' = H, F$ and $i \neq i'$. Before we are going to characterize the first order condition it is shown that the solution to (2.22) corresponds to a global maximum:

Lemma 2.1. *The second order condition for a global maximum is fulfilled, that is* $\frac{\partial \vartheta_i}{\partial g_i} < 0$

Proof. See Appendix 2.6.2. □

Relative country size is summarized in $\Omega_i = (\Omega_{i'})^{-1}$ which is equal to 1 if the countries are symmetric. Note that only relative differences in the fundamentals affect government expenditures. The third term in equation (2.22) represents the positive marginal utility

[17] See Appendix 2.6.1 for the derivation of the subutility in open industries.

of a higher supply of the public good. The second term represents the marginal utility loss due to the crowding out of private firms in tradable and non-tradable industries. As we discussed before, the average diversity of products in equilibrium is lower with higher public production. The first bracket is positive and dampens the loss described by the second term. This dampening effect comes from the fact that domestic public production affects only the range of domestic firms - not the diversity of available foreign varieties. Since households have a love of variety, subutility in open industries is higher than in closed ones. Due to the crowding out of domestic firms, the diversity of domestic relative to foreign varieties decreases which increases the relative weight of open industries. This dampening effect is larger the higher the integration of the goods market which is measured by τ. Without integration of the goods market, eq. (2.22) is solved for $g = \frac{1-\eta}{1-\eta+\frac{\eta}{\nu}} < 1-\eta$. By inspecting equation (2.22), it can be seen, that the degree of openness plays no longer a role if $\nu \to 1$, i.e., in a situation under perfect competition and no love of variety. Moreover, the effect of the asymmetry between countries on optimal government share vanishes. Prices equalize (see equation 2.19) since goods are homogeneous. Then, optimal government share is given by $g = 1 - \eta$, identical for both countries.

According to eq. (2.22) the foreign country affects optimal government size through its choice of $g_{i'}$. The following Proposition describes the interaction between the two governments:

Proposition 2.2. *Domestic optimal government share depends negatively on foreign optimal government share if* $\tau > 0$.

Proof. See Appendix 2.6.4. □

Proposition 2.2 implies that government expenditures are strategic substitutes. If government spending in the foreign country is increased, foreign firms exit the market and fewer varieties are produced in country F. As a result, not only utility in the foreign country but also in home is reduced. The dampening effect of openness on the opportunity costs of public good provision in H (first term in eq. (2.22)) are also smaller. Therefore, the domestic government has an incentive to reduce government spending. If the foreign government share is equal to 1, there are no foreign varieties available for consumption. Therefore, $g_i(g_{i'} = 1) = \frac{1-\eta}{1-\eta+\frac{\eta}{\nu}}$, which is equal to the optimal government share in a closed

economy.

The two reaction functions $g_H(g_F, \tau, \nu, \eta, \Omega_F)$ and $g_F(g_H, \tau, \nu, \eta, \Omega_H)$ are illustrated in figure 2.1.[18]

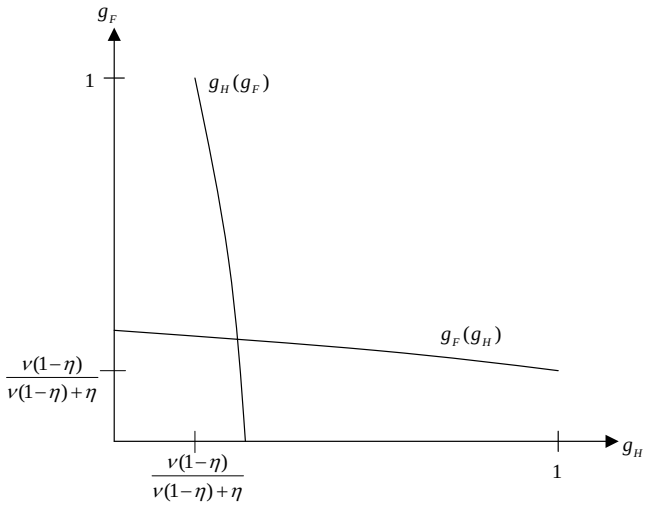


Figure 2.1: Governmental reaction functions

For a first comparative-static investigation of the optimal government share in a single country it is interesting to look at the symmetric case. Under the assumption of identical countries, we are able to calculate explicitly the equilibrium value of the Nash game of the public sector.

2.3.2 Symmetric Countries

Relative country size is captured in the parameter Ω_i which is equal to 1 for identical countries. In this case $g_H = g_F \equiv g$ is a mutually best response of both governments. This optimal g is given by

$$g = \frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}(1-\frac{\tau}{2})} \tag{2.23}$$

This gives us the following Proposition:

Proposition 2.3. *In the equilibrium with identical countries, the optimal government share depends positively on τ and ν.*

[18]The proof of the existence and uniqueness of the equilibrium is presented in the Appendix 2.6.3.

Proof. Inspection of (2.23). □

The effect of openness on the optimal government share interacts with love of variety (see also eq. (2.29) later).[19] Only if households love varieties ($\nu < 1$), subutility in open industries is higher than in a closed industry. Thus, the more open a country, the higher is a household's utility. Since the consumer can benefit more strongly from foreign varieties in more open economies, the importance of domestic varieties diminishes. This provides an incentive for governments to set a higher g. Optimal government expenditure in a closed economy ($\tau = 0$) is equal to $g = \frac{1-\eta}{1-\eta+\frac{\eta}{\nu}}$ and in a totally open economy ($\tau = 1$) equal to $g = \frac{1-\eta}{1+\eta\frac{1-\nu}{2\nu}}$.

A higher ν (that is a lower love of variety) implies a higher optimal government spending. Since the negative effect on utility - due to a crowding out of varieties - is low when love of variety is low, the public sector sets a higher government share.

2.3.3 Asymmetric Countries

Having obtained an insight for the effect of the different parameters on government spending in a symmetric equilibrium, I now turn to the asymmetric case. Note, that only the relative difference between the two countries enters the first order condition. I first consider some limiting cases. If $\Omega_{i'} \to 0$, i.e., country i' becomes infinitesimally small. Thus, we are able to analyze the interaction between a very large and small country which is often discussed in the literature. For $\Omega_{i'} \to 0$ the solution for g_i (given by (2.22)) reduces to $\frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}}$, which coincides with the optimal government size in a closed economy. Since $(\Omega_i)^{-1} = \Omega_{i'}$, $\Omega_{i'} \to 0$ implies $\Omega_i \to \infty$. Therefore, the solution for $g_{i'}$ is given by $\frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}(1-\tau)}$. Hence not surprisingly, while for the large country the degree of openness does not affect government spending, the infinitesimally small country benefits from more openness. Further, in this limiting cases, domestic optimal government share is independent of the foreign government share.

Proposition 2.4 summarizes the effects of the asymmetry between the two countries on the Nash equilibrium of the public sector.

[19] The discussion in Section 2.4.1 will make clear, that in the case of symmetric countries there are no gains from trade due to price differentials between the two countries. Since the public sector affects only the diversity of varieties, the measure for the love of variety drives this result.

Proposition 2.4. *The bigger and more productive is country i relative to the country i' (lower $\Omega_{i'}$), the lower is optimal government share in country i and the higher in country i'.*

Proof. See Appendix 2.6.4. □

If in country i overhead capital requirement is relatively low or if capital endowment is relatively high, more varieties are produced in country i. Relatively high productivity and labor endowment imply that a larger amount of each variety is produced. Hence, gains from opening to trade are larger for the relatively small country (i') because it benefits from a relatively broader range of foreign goods or relatively more of a certain variety. The magnitude of the gains from opening are decisive for the costs of public good provision. The dampening effect (the first term in equation (2.22)) on the costs of public good provision increases in the gains from trade.[20] Therefore, the costs of public good provision in terms of utility are relatively small in the small or less productive country.

It is obvious from equation (2.22) that - for a given foreign government share - a higher τ results in a higher optimal domestic government share. That is, the reaction functions rotate outwards if τ increases. However, since the curves are negatively sloped, it is not a priori clear whether openness does increase government spending in both countries. The symmetric case already showed that openness has a positive effect on optimal government spending in equilibrium. The limiting asymmetry cases show that the infinitely rich or large country does not benefit from openness and therefore, government spending does not depend on openness. While the optimal government share of the infinitely poor or small country depends positively on τ. We have[21]

$$\left.\frac{dg_i}{d\tau}\right|_{\Omega_{i'}\to\infty} > \left.\frac{dg_i}{d\tau}\right|_{\Omega_{i'}=1} > \left.\frac{dg_i}{d\tau}\right|_{\Omega_{i'}\to 0} = 0 \ ,$$

which let conjecture that the effect of openness on optimal government share is decreasing in the relative size of of the country. I provide some simulation outcomes (see figure 2.2) which support the conjecture that $\frac{d^2 g_i}{d\tau d\Omega_{i'}} > 0$ and $\frac{dg_i}{d\tau} > 0 \ \forall \ \Omega_{i'} \neq 0$.[22]

[20] Note that the costs of public good provision in a closed economy is independent of country size.

[21] Remind: that $g_i|_{\Omega_{i'}\to\infty} = \frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}(1-\tau)}$, $g_i|_{\Omega_{i'}=1} = \frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}(1-\frac{\tau}{2})}$ and $g_i|_{\Omega_{i'}\to 0} = \frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}}$.

[22] The program code for the simulation in Mathematica 6.0 is available from the author upon request.

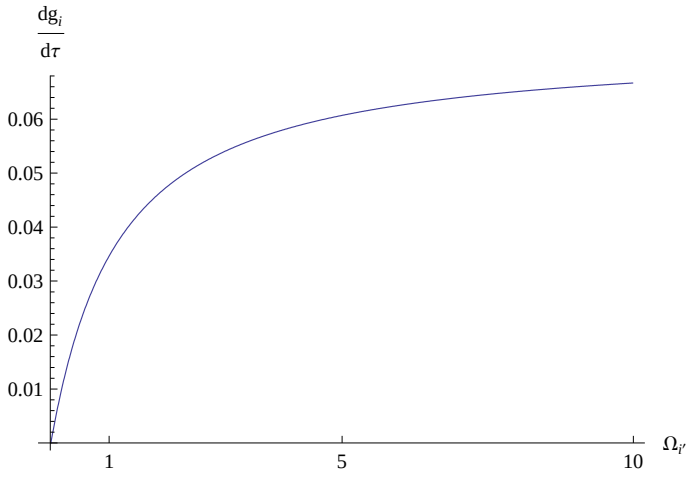


Figure 2.2: Effect of τ on optimal g_i subject to $\Omega_{i'}$ ($\nu = 0.7, \tau = 0.3, \eta = 0.6$). The plot looks qualitatively the same for various values of $\nu, \tau, \eta \in (0, 1)$.

An easier and more tractable alternative to the case of asymmetric countries is the extension of the scenario with two symmetric countries to one with N symmetric countries. This approach captures important aspects of the asymmetric country case, because each individual economy differs from the rest of the world, which is larger than the country under consideration if $N > 2$. The Krugman-framework is easily extended to N countries and the symmetric N-country Nash equilibrium of the governments is derived straightforwardly (see Appendix 2.6.5 for the derivation). Optimal government share in the Nash equilibrium is given by the following expression

$$g = \frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}\left(1-\tau\frac{(N-1)}{N}\right)} \, .$$

For $N = 1$ we obtain the solution for the limiting case of a very large country and for $N \to \infty$ the one for the infinitesimal small country. It can easily be shown that the effect of openness is increasing in N:

$$\frac{\partial^2 g}{\partial\tau\partial N} = \frac{(1-\eta)\eta\frac{1-\nu}{\nu}\frac{1}{N^2}(1+\eta\frac{1-\nu}{\nu}+\frac{N-1}{N}\eta\frac{1-\nu}{\nu}\tau)}{\left(1+\eta\frac{1-\nu}{\nu}(1-\tau\frac{N-1}{N})\right)^3} > 0 \, .$$

Put differently, the effect of τ on g is decreasing in country size.

2.3.4 Welfare

It is well known from the literature that non-cooperative fiscal policies may be too expansionary if there are positive terms of trade effects.[23] Of course, a similar result follows here. If $\tau > 0$, an increase in H's public expenditure decreases the range of available varieties not only in the home country. This negative effect on utility in country F is not taken into account by H's government when choosing the optimal level of public good production. From a country's point of view, optimal public good provision increases with openness since the more a country is integrated into the world market (higher τ), the more costs of public good provision are exported. It follows that uncoordinated fiscal policies lead to an inefficiently high level of public good production.

For illustration consider the case of two symmetric countries.[24] Total welfare is given by $2U$. If we consider a social planner who wants to maximize aggregate welfare, public good provision in both countries should equal $g^P = \frac{1-\eta}{1-\eta+\frac{\eta}{\nu}}$ (g^P denotes government share set by a social planner) which is equal to the level in autarky. However, if both countries choose separately their public good provision, they set g according to (2.23). It is easy to see that $g^P < \frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}(1-\frac{\tau}{2})} = g$. It follows that there is overprovision of the public good without cooperation and that coordination between the two governments would increase aggregate welfare.

2.4 Extensions

2.4.1 Love of Variety versus Market Power

The aim of this section is to separate the role of market power from love of variety. In the standard Dixit-Stiglitz case we are not able to distinguish between the two effects. I follow Benassy (1996) who provides a generalization of the standard Dixit-Stiglitz assumption.[25] The nice and special feature of this extension is to disentangle the parameter

[23] See for example van der Ploeg (1987), Turnovsky (1988), Chari and Kehoe (1990), Devereux (1991), Anderson (2006), Egger and Falkinger (2006) and Epifani and Gancia (2009) for the discussion of overprovision of public goods due to terms of trade effects.

[24] The problem of overprovision in a non-cooperative equilibrium exists, of course, also if countries are asymmetric. The interested reader is referred to the Appendix 2.6.6.

[25] The working paper version of Dixit and Stiglitz (1977) already discusses this general case.

for monopolistic power or elasticity of substitution from the one for love of variety. Under the Benassy extension the subutility is given by

$$Y_{ij} = (N_{ij})^{\rho+1-\frac{1}{\nu}} \left(\int_{k \in \mathscr{N}_{ij}} \left(y_{kj}^{i} \right)^{\nu} dk \right)^{\frac{1}{\nu}}, \quad i = H, F \ , \tag{2.24}$$

where $N_{ij} = |\mathscr{N}_{ij}|$ denotes the measure of varieties from industry j consumed in country i. The love of variety is captured in the parameter $\rho \geq 0$. If ρ is equal to zero there is no love of variety and if $\rho = \frac{1-\nu}{\nu}$ we are back to the standard Dixit-Stiglitz case.[26]

The demand curve for a variety changes as follows

$$y_{kj}^{i} = (N_{ij})^{\rho \frac{\nu}{1-\nu}-1} \left(\frac{p_{kj}}{P_{ij}} \right)^{\frac{-1}{1-\nu}} Y_{ij} \quad \forall \ k \in \mathscr{N}_{ij} \ , \ \forall \ j \in [0,1] \tag{2.25}$$

where $P_{ij} := (N_{ij})^{-\rho+\frac{1}{\sigma-1}} \left(\int_{k \in \mathscr{N}_{ij}} (p_{ki})^{1-\sigma} \, dk \right)^{\frac{1}{1-\sigma}}$ is the price index per industry and may be interpreted as the unit cost function of the subutility Y_{ij} (2.24).

Compared to the results presented so far, the subutilities for traded and non tradable industries change as follows:

$$\begin{aligned} Y_{i,j>\tau}(g_i) &= (n_i)^{\rho+1} \, x_i \\ Y_{i,j\leq\tau}(g_i, g_{i'}) &= \left(\tfrac{n_i+n_{i'}}{n_i} \right)^{\rho} \left(\tfrac{(I_i+I_{i'})n_i}{I_i(n_i+n_{i'})} \right)^{\frac{1}{\nu}-1} Y_{i,j>\tau}(g_i) \end{aligned} \tag{2.26}$$

for $i, i' = H, F$, $i \neq i'$, and note that n_i and I_i are both functions of g_i. Subutility in closed industries depends positively on the love of variety while the parameter for market power has no effect.

When there is no love of variety, $\rho = 0$, it is not clear anymore whether subutility in open industries is higher than in closed ones.[27] Whether $\frac{(I_i+I_{i'})n_i}{I_i(n_i+n_{i'})}$ is greater or smaller than 1, depends on the relative prices of foreign and domestic varieties. Substituting

[26] See Montagna (2001) for a discussion of the welfare effects from trade under the two cases, Dixit-Stiglitz versus no love of variety. To distinguish between external economies of scale in output production and elasticity of substitution has become very common in recent theoretical contributions of international trade, e.g., Egger and Kreickemeier (2009), Felbermayr et al. (2008) and Blanchard and Giavazzi (2003).

[27] Note that the utility functions between non-tradable and tradable industries are different functions. While preferences in the former are defined over all n_i domestic goods, preferences in the latter are defined over all $n_H + n_F$ domestic and foreign varieties. Given the available goods, n_i in closed industries and $n_H + n_F$ in open industries, the consumer chooses optimally consumption of each variety. In open industries, marginal utility of not consuming a certain foreign variety y_{kj}^{i} is infinity as marginal utility

$I_i = n_i p_i x_i$, $i = H, F$, and using (2.14) yields

$$\frac{(I_i + I_{i'})n_i}{I_i(n_i + n_{i'})} = \frac{n_i + n_{i'}\left(\frac{p_i}{p_{i'}}\right)^{\frac{\nu}{1-\nu}}}{n_i + n_{i'}} \tag{2.27}$$

which is greater than 1 if $p_i > p_{i'}$ and smaller than 1 if $p_i < p_{i'}$. In words, if the average price in open industries is lower than in closed ones, subutility in open industries is higher than in closed industries. Recalling that the relative price of foreign to domestic varieties is equal to $p_F = \left(\frac{A_H}{A_F}\frac{\bar{L}_H}{\bar{K}_H}\frac{\bar{K}_F}{\bar{L}_F}\frac{K_H^*}{K_F^*}\right)^{1-\nu}$, the term (2.27) for a household in H is greater than 1 if, anything equal, H is more capital rich, less productive in A_H or overhead capital requirement is lower.

Governments maximization of the household's utility (equation (2.21) subject to (2.26)) yields following first order condition:

$$\begin{aligned}\phi_i \;:=\; & \eta\tau\rho\left(\frac{1}{1-g_i} - \frac{1}{1-g_i+(1-g_{i'})\kappa_{i'}}\right) \\ & + \eta\tau\frac{1-\nu}{\nu}\left(\frac{1}{1-g_i+(1-g_{i'})\kappa_{i'}} - \frac{1}{1-g_i+(1-g_{i'})\Omega_{i'}}\right) \\ & - \eta(\rho+1)\frac{1}{1-g_i} + (1-\eta)\frac{1}{g_i} \;=\; 0\end{aligned} \tag{2.28}$$

with

$$\begin{aligned}\Omega_{i'} &= \left(\frac{A_{i'}}{A_i}\right)^{\nu}\left(\frac{K_i^*}{K_{i'}^*}\right)^{1-\nu}\left(\frac{\bar{K}_{i'}}{\bar{K}_i}\right)^{1-\nu}\left(\frac{\bar{L}_{i'}}{\bar{L}_i}\right)^{\nu} \\ \kappa_{i'} &:= \frac{\bar{K}_{i'}K_i^*}{\bar{K}_i K_{i'}^*}\end{aligned}$$

for $i, i' = H, F$ and $i \neq i'$. As before, the last term in equation (2.28) captures the positive marginal utility of a higher supply of the public good. The third term captures

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with respect to y_{kj}^i is given by $\frac{\partial Y_{ij}}{\partial y_{kj}^i} = N_{ij}^{1-\frac{1}{\nu}}\left(\int_{k\in\mathcal{N}_{ij}}\left(y_{kj}^i\right)^{\nu}dk\right)^{\frac{1}{\nu}-1}\left(\frac{1}{y_{kj}^i}\right)^{1-\nu}$. It follows that even the household in the country with low prices whose subutility in open industries is lower than in closed industries will trade. The central point is that the household can not decide about the number of different goods she consumes. Given the range of different goods, she only chooses (optimally) how much of each variety she wants to consume. That there is trade even if for one country utility in open industries is lower than without trade is a peculiar outcome. Therefore, in a world without love of variety and differentiated goods, one should have different preferences where the consumer decides simultaneously about the number of different varieties and the quantity of a certain variety.

the marginal utility loss due to the crowding out of private firms in each tradable and non-tradable industry, which is larger the higher the love of variety. The first term in (2.22) (derived under the assumption of $\rho = \frac{1-\nu}{\nu}$) combined the first two terms in (2.28). The first term in (2.28) is positive and captures the love of variety effect in open industries.[28] The second term is the income gain/loss in terms of utility, which I call the income effect. It is positive if the inequality $\kappa_{i'} < \Omega_{i'}$ holds which is equal to the inequality $p_{i'} < p_i$.[29] If the fundamentals of the economy are such that the price of foreign varieties is smaller than the price of domestic varieties, the income effect is positive since a relative low price of foreign varieties implies that the average price in open industries is lower than the average price in closed industries. If foreign varieties are more expensive than domestic ones the income effect will be negative. The price differential between the two countries has an effect as long as the firms have market power or the elasticity of substitution is finite, i.e. $\nu < 1$. It is obvious that if the income effect is positive for country H, it is negative for country F and vice versa.

Consider for a moment the case without love of variety, i.e., $\rho = 0$. The first term in (2.28) disappears. Openness affects government expenditure only through the income effect. Openness to trade does not necessarily affect government spending positively. If foreign prices are lower than domestic ones, there are gains from trade for the domestic country and the domestic optimal government share does increase in openness. In contrast, optimal government share of the foreign country decreases in openness.

Equation (2.28) illustrates that if the love of variety is sufficiently large (which is definitely the case under the Dixit-Stiglitz assumption there are gains from trade for both countries and government spending is larger in open economies than in closed ones.

If the countries are symmetric, then $\kappa_i = 1$ and $\Omega_i = 1$ and the second term in the first order condition (eq. (2.28)) disappears. Thus, in a world of identical countries the degree of market power or elasticity of substitution has no effect on optimal public good

[28] Note, that the first bracket in equation (2.28) can be rewritten to $\frac{1}{1-g_i} - \frac{1}{1-g_i+(1-g_{i'})\kappa_{i'}} = \frac{1}{1-g_i}\frac{n_{i'}}{n_i+n_{i'}}$. It is apparently increasing in the relative number of foreign varieties.

[29] This can be seen after some rearranging:
$\kappa_{i'} < \Omega_{i'} \Leftrightarrow \frac{\bar{K}_{i'}K^*_i}{\bar{K}_i K^*_{i'}} < \left(\frac{A_{i'}}{A_i}\right)^{\nu}\left(\frac{K^*_i}{K^*_{i'}}\right)^{\nu}\left(\frac{\bar{K}_{i'}}{\bar{K}_i}\right)^{1-\nu}\left(\frac{\bar{L}_{i'}}{\bar{L}_i}\right)^{\nu} \Leftrightarrow 1 < \left(\frac{p_i}{p_{i'}}\right)^{\frac{\nu}{1-\nu}}$.

provision. The optimal g is given by

$$g = \frac{1-\eta}{1+\eta\rho(1-\frac{\tau}{2})} \tag{2.29}$$

The effect of openness on the optimal government share plays together with ρ, the parameter for love of variety. If individuals have no love of variety, openness won't have an effect on government spending. The higher ρ, i.e., the higher the love of variety, the lower is optimal government spending. This result makes clear that the positive relation between ν and public spending derived in Section 2.3 for the Dixit-Stiglitz framework is driven by the love of variety and not by the elasticity of substitution.

To conclude

Proposition 2.5. *With two identical countries, optimal government spending depends negatively on the parameter for love of variety. Further, optimal government spending depends not on the elasticity of substitution. Openness has a positive effect on optimal government size if consumers have a love of variety.*

2.4.2 Labor or Capital Intensive Public Sector

The equilibrium was derived under the assumption that government activity does not distort the relative factor endowment available for private production. That is, I assumed that $\beta_i = \frac{\bar{L}_i}{\bar{K}_i}$. This assumption is important in order to focus on interactions between openness and the government sector without having a distortion by the government sector on prices and supply. The only effect of a government expansion was the crowding out of private firms. The aim of this section is to analyze the additional effects of government activity if public good production is more labor intensive or more capital intensive than the private sector. Consider equation (2.5). A large β_i implies that productivity of capital is large which in turn implies that employment of capital in public good production is low relative to the employment of labor.

Remind that cost minimizing production implies that

$$g_{Ki} = g_{Li}\frac{\bar{L}_i}{\beta_i \bar{K}_i} \ .$$

The share of capital endowment employed in the public sector is proportionally increasing in the share of labor endowment in the public sector. When $\beta_i < \frac{\bar{L}_i}{\bar{K}_i}$, then $g_{Li} < g_{Ki}$ which means that the public sector is more capital intensive than the private sector. If $\beta_i > \frac{\bar{L}_i}{\bar{K}_i}$ the reverse holds.

Cost minimal production of a public good is thus given by

$$G_i = \beta_i g_{Ki} \bar{K}_i = g_{Li} \bar{L}_i.$$

The factor proportion supplied to the private sector is equal to $\frac{(1-g_{Ki})\bar{K}_i}{(1-g_{Li})\bar{L}_i}$ with $g_{Ki} = g_{Li}\frac{\bar{L}_i}{\beta_i \bar{K}_i}$. As before, there is one public choice parameter since there is a one-to-one mapping between g_{Ki} and g_{Li}. Therefore, in the following g_{Ki} is replaced by $g_{Li}\frac{\bar{L}_i}{\beta_i \bar{K}_i}$. This implies for the relative factor prices

$$\frac{w_i}{r_i} = \frac{\nu}{1-\nu}\frac{\bar{K}_i}{\bar{L}_i} B_i^{-1} \ ,$$

where I defined $B_i := \frac{1-g_{Li}}{1-\frac{g_{Li}\bar{L}_i}{\beta_i \bar{K}_i}}$. Note that $\frac{\partial B_i}{\partial g_{Li}} \gtrless 0$ if $\beta_i \lesseqgtr \frac{\bar{L}_i}{\bar{K}_i}$. Since the supply of a variety and labor demand of a firm depend on the relative factor prices, both are now affected by government activity:

$$x_i = A_i K_i^* \frac{\bar{L}_i}{\bar{K}_i} B_i \tag{2.30}$$

and

$$L_i = K_i^* \frac{\bar{L}_i}{\bar{K}_i} B_i \ .$$

The range of firms is given by equation (2.16) with g_i replaced by $g_{Ki} = g_{Li}\frac{\bar{L}_i}{\beta_i \bar{K}_i}$:

$$n_i = (1 - g_{Li}\frac{\bar{L}_i}{\beta_i \bar{K}_i})\frac{\bar{K}_i}{K_i^*}. \tag{2.31}$$

The crowding out of the extensive margin of production due to an expansion of the public sector is given by: $\frac{\partial n_i}{\partial g_{Li}} = -\frac{\bar{L}_i}{K_i^*}\frac{1}{\beta_i}$. We see that the smaller is β_i, the stronger is the crowding out of firms. As long as the public sector employs capital for production, a crowding out of private firms takes place.

The price of foreign varieties depends on the public share in home and foreign:

$$p_F = \left(\frac{A_H}{A_F}\left(\frac{B_H \bar{L}_H \bar{K}_F}{B_F \bar{K}_H \bar{L}_F}\right)\frac{K_H^*}{K_F^*}\right)^{1-\nu}. \tag{2.32}$$

Under the assumption of $\beta_i = \frac{\bar{L}_i}{\bar{K}_i}$, government activity does only influence the range of firms producing a variety in equilibrium. However, if we allow for $\beta_i \neq \frac{\bar{L}_i}{\bar{K}_i}$, there is no equilibrium variable which stays unaffected by the government share. For analyzing the effect of government activity we have to distinguish two cases: $\beta_i > \frac{\bar{L}_i}{\bar{K}_i}$ and $\beta_i < \frac{\bar{L}_i}{\bar{K}_i}$.

Case 1: $\beta_i > \frac{\bar{L}_i}{\bar{K}_i}$

If $\beta_i > \frac{\bar{L}_i}{\bar{K}_i}$, the public sector produces more labor intensive than the private sector, that is $g_{Ki} < g_{Li}$. There is relatively less labor available for the private sector. This implies a higher relative wage rate compared to the case where $\beta_i = \frac{\bar{L}_i}{\bar{K}_i}$. Consider now an increase in government activity. An expansion of the public sector increases g_{Li} by more than g_{Ki} and hence the factor proportion of capital relative to labor supplied to the private sector (given by $B_i^{-1}\frac{\bar{K}_i}{\bar{L}_i}$) increases. As a result the relative factor price $\frac{w_i}{r_i}$ increases. Demand for labor and the supply of each variety are decreasing in the factor proportion $B_i^{-1}\frac{\bar{K}_i}{\bar{L}_i}$ and hence decrease with an expansion of the public sector if $\beta_i > \frac{\bar{L}_i}{\bar{K}_i}$. Because of a decrease in the factor price of capital, the fixed cost decrease. This allows each firm to produce at a lower scale. It follows that for given public spending in the foreign country, an expansion of the government sector increases the relative price of domestic varieties. Hence, an increase in government spending improves the terms of trade if the public sector produces more labor intensive.

Hence, this model does not only allow for the love of variety effect due to crowding out of firms, it also captures the widely discussed positive terms of trade effect with the more realistic assumption that the public sector produces more labor intensive.[30]

Case 2: $0 < \beta_i < \frac{\bar{L}_i}{\bar{K}_i}$

For completeness, although less realistic case, if $\beta_i < \frac{\bar{L}_i}{\bar{K}_i}$, the public sector produces more capital intensive than the private sector, that is $g_{Li} < g_{Ki}$. An expansion of the public sector increases g_{Li} by less than g_{Ki} and hence the factor proportion of capital relative to labor supplied to the private sector (given by $B_i^{-1}\frac{\bar{K}_i}{\bar{L}_i}$) decreases if the government share

[30] Assuming an alternative public good production such as $G = g\bar{L}$, where the public good is produced exclusively with labor, only the terms of trade effect remains (see Appendix 2.7.1).

increases. All the effects discussed above change their sign except, of course, the negative effect on the number of firms is still present.

To sum up, the labor intensity in the public sector relative to the private sector is decisive for the crowding out of the extensive margin of production (number of firms) and intensive margin of production (output per firm). If the public sector produces labor intensive, there is less crowding out of private firms. As a result, the love of variety effect is smaller. However, there is a positive terms of trade effect due to the crowding out of the intensive margin of production.[31] In contrast, a capital intensive public sector implies a larger crowding out of firms but a deterioration of the terms of trade.

2.5 Conclusion

Based on a general equilibrium model, this chapter has identified a new channel how trade openness may lead to larger governments. The model consists of two heterogeneous countries which both comprise a public and private sector. There are tradable and non-tradable private industries, endogenous product differentiation within the private industries and consumers have a love of variety. In this framework, the effect of openness to trade on optimal public good provision is analyzed. Moreover, the effects of heterogeneity between countries on optimal public good provision are discussed.

The idea that government expansion may be achieved on expense of the welfare of other countries due to the terms of trade effect (TOTE) is familiar. However, this chapter shows that under the assumption of endogenous firm entry and Dixit-Stiglitz preferences, the cost of public good provision may be exported due to the love of variety effect (LOVE). Since a governmental expansion crowds out only domestic varieties, the costs of public good provision in terms of welfare are lower, the more industries are open. Therefore, government spending depends positively on openness if consumers have a love of variety. Furthermore, since the gains from trade are larger for a small or less productive country, the smaller country chooses a higher government share. In contrast, in a closed economy, optimal government share is invariant with respect to the size of the respective economy.

[31] In Section 2.7.2 the first order condition is split in the different parts, costs due to crowding out of extensive and intensive margin of production and gains from trade due to love of variety and terms of trade effect.

The possibility of governments to export the costs of public good provision leads to an equilibrium where both governments act too expansionary. An agreement between the two governments reducing government activity in both countries would lead to a higher aggregate welfare.

The main focus of this chapter is put on the crowding out of private firms (extensive margin) and hence on the LOVE. However, the presented theoretical framework is able to account also for crowding out of the intensive margin and hence the TOTE. Hence, the two possibilities of exporting costs of public good provision and their implications for optimal government size in open economies can be discussed in one unified framework. Two production factors and the differences in factor intensity of public versus private production are decisive for the effect of government activity on private sector's production and the relative factor prices. The degree of crowding out of the extensive and intensive margin of production is decisive for the size of the LOVE and TOTE.

The chapter provides a foundation for a number of empirical research questions. A first empirical investigation whether the LOVE on public spending exists in the data is provided in Chapter 3. Whether the LOVE or TOTE is of higher empirical importance and whether the strength of the two effects depends on relative factor intensity in private and public sector is left for further empirical research.

A natural and interesting theoretical extension would be to take capital flows between countries into account. This may allow to combine the race to the bottom argument, based on the fear of capital outflow, with overprovision arising from the possibility to export costs of public good provision.

2.6 Appendix A: Proofs and Derivations

2.6.1 Derivations

Derivation of eq. (2.13)

Using demand $y_i^{i'} = \left(\frac{p_i}{P_j}\right)^{\frac{-\nu}{1-\nu}} \frac{I_{i'}}{P_j}$, $i, i' = H, F$ we see that consumption of in H relative to consumption in F of a variety produced in H is equal to the relative income:

$$\frac{y_H^H}{y_H^F} = \frac{I_H}{I_F} \, .$$

Using this, the equation for market clearing in a tradable industry, $x_H = y_H^H + y_H^F$, and the relation $\frac{y_H^H}{y_F^H} = \left(\frac{p_F}{p_H}\right)^{\frac{1}{1-\nu}}$ we get the demand for tradable varieties

$$(y_H^H, y_F^H) = \left(\frac{I_H x_H}{I_F + I_H}, \left(\frac{p_H}{p_F}\right)^{\frac{1}{1-\nu}} \frac{I_H x_H}{I_F + I_H}\right)$$
$$(y_H^F, y_F^F) = \left(\frac{I_F x_H}{I_F + I_H}, \left(\frac{p_H}{p_F}\right)^{\frac{1}{1-\nu}} \frac{I_F x_H}{I_F + I_H}\right)$$

Further by using the condition $\frac{x_H}{x_F} = \left(\frac{p_H}{p_F}\right)^{\frac{-1}{1-\nu}}$ (eq. (2.14)) expression (2.13) is obtained. Note that the derivation of equation (2.14) does not require (2.13).

Derivation of the Subutility in Open Industries

For $i, i' = H, F$ and $i \neq i'$:

$$\begin{aligned} Y_{i,j\leq\tau} &= \left(n_{ij}\left(y_i^i\right)^\nu + n_{i'j}\left(y_{i'}^i\right)^\nu\right)^{\frac{1}{\nu}} \\ &= y_i^i \left(n_{ij} + n_{i'j}\left(\frac{y_{i'}^i}{y_i^i}\right)^\nu\right)^{\frac{1}{\nu}} \end{aligned} \tag{2.33}$$

Further, using $I_i = p_i n_i x_i = n_{ij} p_i y_i^i + n_{i'j} p_{i'} y_{i'}^i$ and the fact that $\frac{y_{i'}^i}{y_i^i} = \left(\frac{p_i}{p_{i'}}\right)^{\frac{1}{1-\nu}}$ implies

$$\frac{n_i x_i}{y_i^i} = n_{ij} + n_{i'j}\left(\frac{y_{i'}^i}{y_i^i}\right)^\nu \, .$$

Combining with (2.33) and substituting y_i^i, $i = H, F$ from (2.13), we get the subutility in

open industries in expression (2.20).

Derivation of the First Order Condition (eq. (2.22))

We first rewrite the objective function of the government in the form ($i = H, F$):

$$\max_{g_i} \ \eta\tau\frac{1-\nu}{\nu}\left(\log(I_i(g_i)+I_{i'}(g_{i'}))-\log I_i(g_i)\right)+\eta\log\left(n_i(g_i)\right)^{\frac{1}{\nu}}x_i+(1-\eta)\log G_i(g_i)$$

The first order condition of this problem is given by:

$$0 \ = \ \eta\tau\frac{1-\nu}{\nu}\left(\frac{\partial\log(I_i+I_{i'})}{\partial g_i}-\frac{\partial\log I_i}{\partial g_i}\right)+\frac{\eta}{\nu}\frac{\partial\log n_i}{\partial g_i}+(1-\eta)\frac{\partial\log G_i}{\partial g_i} \tag{2.34}$$

This yields equation (2.22).

2.6.2 Proof of Lemma 2.1

Proof. We will show that the solution to the first order condition (2.22) corresponds to a global maximum, that is $\frac{\partial\vartheta_i}{\partial g_i} < 0$.

$$\frac{\partial\vartheta_i}{\partial g_i} = \underbrace{\eta\tau\frac{1-\nu}{\nu}\left(\frac{1}{(1-g_i)^2}-\frac{1}{(1-g_i+(1-g_{i'})\Omega_{i'})^2}\right)}_{\equiv A(g_i)}\underbrace{-\frac{\eta}{\nu}\frac{1}{(1-g_i)^2}-(1-\eta)\frac{1}{(g_i)^2}}_{<0} \tag{2.35}$$

As $\Omega_{i'} \geq 0$ and $g_{i'} \in (0,1)$ we have $A(g_i) \geq 0$. Note that $\frac{\partial A(g_i)}{\partial\Omega_{i'}} > 0$, hence $A(g_i)$ is minimal if $\Omega_{i'} = 0$ and maximal if $\Omega_{i'} \to \infty$.
Now $\Omega_{i'} \to \infty \ \Rightarrow \ A(g_i) \to \eta\tau\frac{1-\nu}{\nu}\frac{1}{(1-g_i)^2}$. Hence, for $\Omega_{i'} \to \infty$,

$$\frac{\partial\vartheta_i}{\partial g_i} \to \frac{\eta}{\nu}\frac{1}{(1-g_i)^2}\underbrace{[\tau(1-\nu)-1]}_{<0}-\frac{1-\eta}{(g_i)^2} < 0 \ .$$

□

2.6.3 Proof of Existence and Uniqueness of Equilibrium

Proof of Existence. Note first that $g_i, g_{i'} \in [0,1]$. Since the reaction functions are continuous and strictly negatively sloped (Proposition 2.2), there exists an equilibrium if

$g_i(g_{i'}=1)>0$. In the following we are going to proof this.

The solution at $g_{i'}=1$ is $g_i(g_{i'}=1)=\frac{\nu(1-\eta)}{\nu(1-\eta)+\eta}<1$. In Proposition 2.2 it is shown that $\frac{dg_i}{dg_{i'}}<0$ which implies that $g_i>\frac{\nu(1-\eta)}{\nu(1-\eta)+\eta}$ for $g_{i'}\in[0,1)$ and $g_i<1$ for $g_{i'}>0$.

This argument holds for both $i,i'=H,F$ and $i\neq i'$ and hence the two functions must intersect at least once as illustrated in figure 2.1.

Moreover, note that because of $g_i(g_{i'}=1)>0$, both countries provide a positive amount of the public good in an equilibrium. □

Proof of Uniqueness. It remains to show that $\frac{\partial g_i}{\partial g_{i'}}$ is strictly monotonic (in- or decreasing). For notational simplicity we will define $\kappa\equiv\eta\tau\frac{1-\nu}{\nu}\Omega_{i'}$ and $B\equiv(1-g_i+(1-g_{i'})\Omega_{i'})$. Note that $\kappa,B>0$. The derivative of (2.36) with respect to $g_{i'}$ is given by

$$\frac{\partial^2 g_i}{(\partial g_{i'})^2}=\frac{-\kappa\left[\frac{\partial^2\vartheta_i}{\partial g_i\partial g_{i'}}B^2-\frac{\partial\vartheta_i}{\partial g_i}2B\Omega_{i'}\right]}{\left[\frac{\partial\vartheta_i}{\partial g_i}B^2\right]^2}$$

Making use of $\frac{\partial^2\vartheta_i}{\partial g_i\partial g_{i'}}=\frac{-2\kappa}{B^3}$ we can write

$$\frac{\partial^2 g_i}{(\partial g_{i'})^2}=\frac{-2\kappa\overbrace{\left[\frac{-\kappa}{B^2}-\frac{\partial\vartheta_i}{\partial g_i}\Omega_{i'}\right]}^{\equiv Z}}{\left(\frac{\partial\vartheta_i}{\partial g_i}\right)^2B^3}$$

Now we have to determine the sign of Z by using eq. (2.35).

$$\begin{aligned}Z&=\frac{-\kappa}{B^2}-\kappa\frac{1}{(1-g_i)^2}+\frac{\kappa}{B^2}+\Omega_{i'}\left(\frac{\eta}{\nu}\frac{1}{(1-g_i)^2}-(1-\eta)\frac{1}{(g_i)^2}\right)\\&=\Omega_{i'}\left[\frac{\eta}{\nu}\frac{1}{(1-g_i)^2}(1-\tau(1-\nu))+\frac{1-\eta}{(g_i)^2}\right]>0\end{aligned}$$

This implies that $\frac{\partial g_i}{\partial g_{i'}}$ is strictly monotone decreasing:

$$\frac{\partial^2 g_i}{(\partial g_{i'})^2}=\underbrace{\frac{\overbrace{-2\kappa Z}^{<0}}{\left(\frac{\partial\vartheta_i}{\partial g_i}\right)^2B^3}}_{>0}<0\,.$$

As the same is true for $\frac{\partial^2 g_{i'}}{(\partial g_i)^2}$, we can conclude that the reaction functions intersect only once.

□

2.6.4 Proof of Propositions 2.1, 2.2 and 2.4

Proof of Proposition 2.1. Since the value of imports equals the value of exports, the volume of trade (denoted by VT) is given by $VT = 2\int_0^\tau p_F y_F^H n_{Fj} dj$. According to (2.13) $y_F^H = \frac{x_F}{1+I_F/I_H}$, net income I_H and therefore demand for a variety produced in F and consumed in H depend negatively on an increase of g_H while the other values remain unaffected. Therefore, the volume of trade depends negatively on g_H. □

Proof of Proposition 2.2. Proposition 2.2 is easily shown by applying the implicit function theorem on the first order condition (equation (2.22)).

$$\frac{dg_i}{dg_{i'}} = -\frac{-\eta\tau\frac{1-\nu}{\nu}\frac{\Omega_{i'}}{(1-g_i+(1-g_{i'})\Omega_{i'})^2}}{\frac{\partial\vartheta_i}{\partial g_i}} \tag{2.36}$$

The expression $\frac{\partial\vartheta_i}{\partial g_i}$ is the second order condition which is negative. Therefore, $\frac{dg_i}{dg_{i'}} < 0$, if $\tau > 0$. □

Proof of Proposition 2.4. Again, the implicit function theorem is applied on the first order condition for given public foreign expenditure to get

$$\left.\frac{dg_i}{d\Omega_{i'}}\right|_{g_{i'}constant} = -\frac{-\eta\tau\frac{1-\nu}{\nu}\frac{-(1-g_{i'})}{(1-g_i+(1-g_{i'})\Omega_{i'})^2}}{\frac{\partial\vartheta_i}{\partial g_i}} > 0\ .$$

The expression $\frac{\partial\vartheta_i}{\partial g_i}$ is the second order condition which is negative. Neglecting the effect of $\Omega_{i'}$ on $g_{i'}$ the result above means that for given $g_{i'}$ optimal g_i is higher the higher $\Omega_{i'}$. Since $\Omega_{i'} = (\Omega_i)^{-1}$, by the same argument, a higher $\Omega_{i'}$ leads to a lower $g_{i'}$ for any given g_i. The lower $g_{i'}$ due to the higher $\Omega_{i'}$ has an additional positive effect on g_i as I have shown in proposition 2.2. Hence, any change in the fundamentals, which makes country i' bigger (higher $\bar{K}_{i'}/\bar{K}_i$ and $\bar{L}_{i'}/\bar{L}_i$) and more productive (higher $A_{i'}/A_i$ and lower $K^*_{i'}/K^*_i$) lowers the equilibrium value of $g_{i'}$ and increases g_i. Graphically the reaction function $g_i(g_{i'})$ rotates outwards and $g_{i'}(g_i)$ rotates inwards. □

2.6.5 N Symmetric Countries

A nice feature of the Krugman framework is its easy extendability to a multi-country model. Assume N identical countries, indexed with $i = 1, ..., N$.

The market clearing condition for each tradable variety is given by

$$x_k = \sum_{i=1}^{N} y_k^i = N y_k$$

where y_k^i denotes consumption of variety k by household i and x_k the production of variety k. A constant fraction of each tradable good is consumed in each country. Because firms are identical, each household consumes an equal amount of each variety. Therefore, we can neglect the indices and write

$$y = \frac{x}{N} \, .$$

Further we assume that the public sector has only an effect on the number of firms. $n_i(g_i)$ may be potentially different between countries. Subutility of an individual household for a tradable industry can be written as

$$Y_{j\leq\tau}(\{g_i\}_{i=1,...,N}) = \left(\sum_{i=1}^{N} \int_0^{n_i} y^\nu dk \right)^{\frac{1}{\nu}} = \left(\sum_{i=1}^{N} n_i y^\nu \right)^{\frac{1}{\nu}} = \left(\sum_{i=1}^{N} n_i \right)^{\frac{1}{\nu}} \frac{x}{N} \, .$$

For the non-tradable industry nothing changes.

$$Y_{j>\tau}(g_i) = (n_i(g_i))^{\frac{1}{\nu}} \, x$$

Governments' objective function is utility of the representative household:

$$\max_{g_i} \quad \eta\tau \log Y_{i,j\leq\tau}(\{g_l\}_{l=1,...,N}) + \eta(1-\tau) \log Y_{i,j>\tau}(g_i) + (1-\eta) \log G_i(g_i) \, .$$

Since government i takes as given the government shares of the other countries when determining its optimal g_i, the first order condition is given by

$$\eta\tau \frac{1}{\nu} \frac{1}{\sum_{l=1}^{N} n_l} \frac{\partial n_i}{\partial g_i} + \eta(1-\tau) \frac{1}{\nu} \frac{1}{n_i} \frac{\partial n_i}{\partial g_i} + (1-\eta) \frac{1}{g_i} = 0$$

which is equivalent to

$$\eta\tau\frac{1-\nu}{\nu}\left(\frac{1}{1-g_i}-\frac{1}{1-g_i+\sum_{i'\neq i}(1-g_{i'})}\right)-\frac{\eta}{\nu}\frac{1}{1-g_i}+(1-\eta)\frac{1}{g_i}=0\ . \tag{2.37}$$

As in a symmetric equilibrium $g_i = g_{i'} = g$ for all $i, i' = 1, ..., N$, $i \neq i'$, the following symmetric government share results

$$g=\frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}(1-\tau\frac{N-1}{N})}\ . \tag{2.38}$$

An increase in the number of countries has qualitatively the same effect as a decrease of i's country size. As the number of countries increases, the cost of public good provision decreases since the relative number of imported goods to domestically produced goods increases. As a result, unilateral optimal government size increases.

2.6.6 Overprovision

This section shows that unilateral fiscal policies are too expansionary from an aggregate welfare point of view. A social planner seeks to maximize aggregate welfare and hence, she takes into account the negative externality on the foreign country's welfare.

Aggregate utility is given by

$$\begin{aligned}U_H+U_F=&\eta\tau\frac{1-\nu}{\nu}\left(\log(I_H+I_F)-\log(I_H)\right)+\frac{\eta}{\nu}\log n_H+\eta\log x_H+(1-\eta)\log G_H\\&+\eta\tau\frac{1-\nu}{\nu}\left(\log(I_H+I_F)-\log(I_F)\right)+\frac{\eta}{\nu}\log n_F+\eta\log x_F+(1-\eta)\log G_F\ .\end{aligned}$$

The social optimum for g_H is determined by the following equation (analogous for g_F):

$$\begin{aligned}\frac{\partial(U_H+U_F)}{\partial g_H}=&\eta\tau\frac{1-\nu}{\nu}\left(\frac{\partial\log(I_H+I_F)}{\partial g_H}-\frac{\partial\log I_H}{\partial g_H}\right)+\frac{\eta}{\nu}\frac{\partial\log n_H}{\partial g_H}+(1-\eta)\frac{\partial\log G_H}{\partial g_H}\\&+\eta\tau\frac{1-\nu}{\nu}\frac{\partial\log(I_H+I_F)}{\partial g_H}=0\ .\end{aligned} \tag{2.39}$$

Comparing this first order condition with equation (2.34) it can be noted that they differ

in the additional last term in equation (2.39). This term captures the negative effect on the foreign country. We have $\eta\tau\frac{1-\nu}{\nu}\frac{\partial \log(I_H+I_F)}{\partial g_H} = -\eta\tau\frac{1-\nu}{\nu}\frac{1}{1-g_H+(1-g_F)\Omega_F} < 0$. Thus $\frac{\partial(U_H+U_F)}{\partial g_H} < 0$ at the solution of (2.34), which together with the second order condition implies that the socially optimal level is higher than the individual optimum.

2.7 Appendix B: Further Technical Discussions

2.7.1 Terms of Trade Effect

This section isolates the terms of trade effect which can be obtained when the public sector produces exclusively with labor. This is a nice exercise to compare the two extremes "only love of variety effect" versus "only positive terms of trade effect" and to close the circle to the existing literature. The following simple production function for the public good is assumed:

$$G_i = g_i \bar{L}_i.$$

The full employment conditions for capital and labor are thus given by

$$\int_0^1 n_{ij} dj K_i = \bar{K}_i \tag{2.40}$$

$$\int_0^1 n_{ij} dj L_i = (1-g_i)\bar{L}_i \tag{2.41}$$

The range of firms per country follows directly from (2.40)

$$n_i = \int_0^1 n_{ij} dj = \frac{\bar{K}_i}{K_i^*} \tag{2.42}$$

Equations (2.41), (2.9) and (2.42) determine the relative factor prices:

$$\frac{r_i}{w_i} = \frac{1-\nu}{\nu}\frac{(1-g_i)\bar{L}_i}{\bar{K}_i} \ . \tag{2.43}$$

It follows that

$$x_i = A_i K_i^* \frac{(1-g_i)\bar{L}_i}{\bar{K}_i} \quad i = H, F \tag{2.44}$$

$$L_i = K_i^* \frac{(1-g_i)\bar{L}_i}{\bar{K}_i} \quad i = H, F \tag{2.45}$$

Because of $p_H = 1$ und (2.43) it follows

$$w_H = A_H \nu \qquad \text{and} \qquad r_H = (1-\nu)\frac{(1-g_H)\bar{L}_H}{\bar{K}_H} A_H$$

Because of $\frac{x_F}{x_H} = \left(\frac{p_H}{p_F}\right)^{\frac{1}{1-\nu}}$ and using (2.44) and $p_H = 1$: we have for p_F

$$p_F = \left(\frac{A_H K_H^* (1-g_H)\bar{L}_H \bar{K}_F}{A_F K_F^* (1-g_F)\bar{L}_F \bar{K}_H}\right)^{1-\nu} \tag{2.46}$$

and hence for the foreign factor prices it follows

$$\begin{aligned} w_F &= \nu \left(A_F\right)^{\nu} \left(\frac{A_H K_H^* (1-g_H)\bar{L}_H \bar{K}_F}{K_F^* (1-g_F)\bar{L}_F \bar{K}_H}\right)^{1-\nu} \\ r_F &= (1-\nu)\left(\frac{(1-g_F)\bar{L}_F}{\bar{K}_F} A_F\right)^{\nu} \left(\frac{A_H K_H^* (1-g_H)\bar{L}_H \bar{K}_F}{K_F^* \bar{K}_H}\right)^{1-\nu} \end{aligned}$$

Finally, the net incomes are given by $I_i(g_i) = (1-g_i)A_i \bar{L}_i p_i$.

The effect of government spending on the equilibrium values is summarized in the following:

$$\begin{aligned} \frac{\partial n_i}{\partial g_i} &= 0 \\ \frac{\partial x_i}{\partial g_i} &< 0, \quad \frac{\partial L_i}{\partial g_i} < 0 \\ \frac{\partial w_i / r_i}{\partial g_i} &> 0 \\ \frac{\partial p_i / p_{i'}}{\partial g_i} &> 0, \quad \frac{\partial w_i / w_{i'}}{\partial g_i} > 0, \quad \frac{\partial r_i / r_{i'}}{\partial g_i} < 0\,. \end{aligned}$$

An increase in government production does not affect the range of firms. Due to an increased demand for labor, labor gets relatively scarce in the private sector and the relative wage rate increases. Demand for labor of each individual private firm decreases and hence, each firm produces a lower quantity. This in turn leads to a terms of trade improvement. In contrast to the model where the public sector crowds out firms, here, the public sector crowds out only production of each firm but does not affect the diversity

of firms.

Optimal public good provision is found by maximizing utility of the representative household. Remind that the subutilities are given by

$$Y_{i,j>\tau} = (n_i)^{\frac{1}{\nu}} x_i \qquad \text{and} \qquad Y_{i,j\leq\tau} = \left(\frac{I_i + I_{i'}}{I_i}\right)^{\frac{1}{\nu}-1} (n_i)^{\frac{1}{\nu}} x_i \; .$$

In contrast to the main part of this chapter, n_i does not depend on g_i, however x_i and the relative prices depend on g_i. Let us consider for the moment the expression $\frac{I_i+I_{i'}}{I_i}$ with $I_i = (1-g_i)A_i\bar{L}_i p_i$.

$$\frac{I_i + I_{i'}}{I_i} = 1 + \frac{1-g_{i'}}{1-g_i}\frac{A_{i'}\bar{L}_{i'}}{A_i\bar{L}_i}p_{i'} = 1 + \left(\frac{1-g_{i'}}{1-g_i}\right)^{\nu}\Omega_{i'} \tag{2.47}$$

where we used $p_{i'} = \left(\frac{1-g_i}{1-g_{i'}}\frac{A_i K_i^* \bar{L}_i \bar{K}_{i'}}{A_{i'} K_{i'}^* \bar{L}_{i'} \bar{K}_i}\right)^{1-\nu}$ and the definition $\Omega_{i'} = \left(\frac{A_{i'}}{A_i}\frac{\bar{L}_{i'}}{\bar{L}_i}\right)^{\nu}\left(\frac{K_i^*}{K_{i'}^*}\frac{K_{i'}}{K_i}\right)^{1-\nu}$. Governments maximization of the household's utility (2.21) subject to (2.44) and (2.47) is equivalent to

$$\max_{g_i} \;\; \eta\tau\frac{1-\nu}{\nu}\log\left[1 + \left(\frac{1-g_{i'}}{1-g_i}\right)^{\nu}\Omega_{i'}\right] + \eta\log(1-g_i) + (1-\eta)\log g_i$$

This yields the following first order condition:

$$0 = \eta\tau(1-\nu)\frac{1}{1+\left(\frac{1-g_i}{1-g_{i'}}\right)^{\nu}\Omega_i}\frac{1}{1-g_i} - \eta\frac{1}{1-g_i} + (1-\eta)\frac{1}{g_i} \tag{2.48}$$

with $\Omega_i = (\Omega_{i'})^{-1}$. The FOC can be interpreted as follows. Again the last term is the positive marginal utility of an increase in the public good provision. The middle term is the negative marginal effect due to the crowding out of production of each variety. The first term dampens the negative marginal effect the more the country is open, i.e., τ is high.

If the countries are identical, the symmetric equilibrium with $g_i = g_{i'} = g$ is given by:

$$g = \frac{1-\eta}{1-\eta\frac{\tau}{2}(1-\nu)} \; .$$

It is no surprise, that openness τ has a positive effect on the optimal government share. An increase in the parameter ν reduces the optimal government share. This is exactly the opposite we obtained in Section 2.3.2 because here the parameter ν captures the elasticity of substitution between varieties and not the love of variety.[32] The public sector has no effect on the available varieties, but on the relative price between the two countries and hence on the terms of trade. The intuition is in line with the one in Epifani and Gancia (2009) which is that a higher ν implies better substitutable varieties. For a government to have a strong positive terms of trade effect, varieties are required to be weak substitutes. Therefore, a low ν implies lower costs of public good provision or to put it differently, more costs of public good provision are exported.

In order to support the intuition lets consider the relative price of foreign varieties (remind that we normalized p_i equal to one):

$$p_{i'} = \left(\frac{1-g_i}{1-g_{i'}}\right)^{1-\nu} \tilde{\Omega}$$

where $\tilde{\Omega} \equiv \left(\frac{A_i K_i^* \bar{L}_i \bar{K}_{i'}}{A_{i'} K_{i'}^* \bar{L}_{i'} \bar{K}_i}\right)^{1-\nu}$. It follows that

$$\frac{\partial p_{i'}}{\partial g_i} = -(1-\nu)\left(\frac{1-g_i}{1-g_{i'}}\right)^{-\nu} \frac{1}{1-g_{i'}} \tilde{\Omega} < 0.$$

For $\nu \to 1$ (perfect substitutes), the price of foreign varieties equals the price of domestic varieties. Therefore, an increase in government spending has no effect on the terms of trade. The smaller ν (imperfect substitutes), the stronger is the negative effect of g_i on $p_{i'}$ and the stronger the positive effect on the terms of trade.

2.7.2 LOV- versus TOT-Effect

In Section 2.3 and Section 2.7.1 we derived optimal government spending under the two extreme assumptions, either only love of variety effect or only terms of trade effect. In the general framework discussed in Section 2.4.2 the two effects were combined. The

[32] One might execute the calculation of the optimal public good provision assuming a Benassy-utility function - distinguishing between love of variety ρ and elasticity of substitution ν - to see that the parameter for love of variety ρ has no effect on the optimal government share.

first order condition in this general setting can be split into the different costs, and the dampening effects which arise in an open economy. Consider welfare of a household in country H:

$$\max_{g_{LH}} \ \eta\tau\frac{1-\nu}{\nu}\log\left(1+\frac{I_F}{I_H}\right)+\eta\log\left(n_H\right)^{\frac{1}{\nu}}x_H+(1-\eta)\log G_H \ .$$

Relative income or relative expenditure for private goods is given by $\frac{I_F}{I_H}=\frac{n_F x_F p_F}{n_H x_H p_H}$. Using the equilibrium condition, $\frac{x_H}{x_F}=\left(\frac{p_F}{p_H}\right)^{\frac{1}{1-\nu}}$, we define $M:=1+\frac{I_F}{I_H}=1+\frac{n_F}{n_H}\left(\frac{x_F}{x_H}\right)^{\nu}$. Using this, the expressions (2.30), (2.31) and $G_i=g_{Li}\bar{L}_i$ derived in Section 2.4.2, the first order condition of the maximization problem above is given by

$$\begin{aligned}\frac{\eta}{\nu n_H}\frac{\partial n_H}{\partial g_{LH}}+\frac{1-\nu}{\nu}\eta\tau\frac{1}{M}\frac{\partial M}{\partial n_H}\frac{\partial n_H}{\partial g_{LH}}\\ +\frac{\eta}{x_H}\frac{\partial x_H}{\partial g_{LH}}+\frac{1-\nu}{\nu}\eta\tau\frac{1}{M}\frac{\partial M}{\partial x_H}\frac{\partial x_H}{\partial g_{LH}}\\ +\frac{1-\eta}{G_H}\frac{\partial G_H}{\partial g_{LH}}=0\end{aligned} \tag{2.49}$$

The effect of government activity on the private sector can be split into two parts: crowding out of the extensive margin (first row of equation (2.49)) and crowding out of the intensive margin (second row of equation (2.49)). While the former contains the love of variety effect the latter reflects the terms of trade effect. The first term in the first row is the marginal costs of public good provision due to the crowding out of firms. The second term in the first row describes the dampening effect due to imports of foreign varieties (the love of variety effect). The first term in the second row is the marginal costs of crowding out the intensive margin of production. The second term in the second column is the dampening effect which describes the terms of trade effect. Note, we see in the equilibrium condition $\left(\frac{x_H}{x_F}\right)^{1-\nu}=\frac{p_F}{p_H}$ that a change in the relative intensive margin of production must result in a change in relative prices (the terms of trade).

We see that the dampening effect of openness, τ, on public good provision comes either due to the love of variety effect (second term, first row) or the terms of trade effect (second term, second row). The strength of the two effects depends i.a. on the degree of crowding out of the two margins of production. The crowding out of the two margins depends on the relative labor intensity in the public sector as discussed in Section 2.4.2.

2.7.3 LOV for Public Goods

I assumed that the household has a love of variety. However, I restricted this assumption to the private sector. In order to generalize the model and to take the assumption of love of variety serious, this section assumes that there is also love of variety for the public goods. I assume that the public sector produces a range of different varieties n_G. For simplicity I assume that the public sector provides a fix amount of each public variety which is normalized to one, $\tilde{G} = 1$. Hence, a bigger public sector implies only a broader range of different public goods. Again the public sector employs a share g of total endowment:

$$n_G = g\bar{L} \; .$$

Utility of the representative household is given by

$$U_i = \eta \int_0^1 \log Y_{ij} dj + (1-\eta) \log G_i \quad \text{for} \quad i = H, F \tag{2.50}$$

where $G = \left(\int_0^{n_G} \tilde{G}^{\nu_G} dl \right)^{\frac{1}{\nu_G}} = n_G^{\frac{1}{\nu_G}} = g^{\frac{1}{\nu_G}} \bar{L}^{\frac{1}{\nu_G}}$ and $\nu_G \in (0,1)$ captures the love of variety for the public goods.

The first order condition changes as follows:

$$\eta\tau \frac{1-\nu}{\nu} \left(\frac{1}{1-g_i} - \frac{1}{1-g_i+(1-g_{i'})\Omega_{i'}} \right) - \frac{\eta}{\nu} \frac{1}{1-g_i} + \frac{(1-\eta)}{\nu_G} \frac{1}{g_i} = 0 \tag{2.51}$$

The first two terms are the cost of public good provision and are of course independent of the love of variety for public goods. The third term which describes the positive marginal utility increases in $\frac{1}{\nu_G}$. If $\nu_G < 1$, positive marginal utility is higher and marginal costs are identical to (2.22). Therefore, (2.51) results in higher public good provision than in (2.22). In a symmetric equilibrium ($\Omega_{i'} = 1$) with $g_i = g_{i'} = g$ the first order condition simplifies to the following equation

$$g = \frac{\frac{1-\eta}{\nu_G}}{\frac{1-\eta}{\nu_G} + \frac{\eta}{\nu} - \eta\tau \frac{1-\nu}{\nu} \frac{1}{2}} \; . \tag{2.52}$$

If the preference for variety is the same for both the private and public goods, i.e., $\nu = \nu_G$, optimal g reduces to

$$g = \frac{(1-\eta)}{1-\eta\tau(1-\nu)^{\frac{1}{2}}} \tag{2.53}$$

which is identical to the optimal government share if the public good is only produced with labor as discussed in Section 2.7.1.

Since the subutility of one unit of a public good is the same as one unit of a private good, in a closed economy, optimal g equals the preference for the public good, $g = 1-\eta$. This is the same result as if we assume one homogeneous private good (perfect substitutes and perfect competition) and one public good. This is in contrast to the optimal g in the closed economy found in Section 2.3. There we have $g = \frac{(1-\eta)}{1-\eta+\frac{\eta}{\nu}} < 1-\eta$. This difference comes from the fact that in the latter there is an additional cost of public good provision. An increase of public good provision crowds out the private sector which decreases utility not only because the amount of private consumption nx decreases but also since the number of varieties decreases. This loss in utility due to a decrease in the number of varieties is compensated if the public sector provides additional public goods.

3

The Effect of Trade Liberalization on Government Size: Empirical Analysis

Due to the increasing international integration of goods markets new challenges for the public sector arise. As outlined in the introduction, on the one hand, a large literature points out that an increase in competition between countries puts pressure on governments and leads to a race to the bottom in public good provision. On the other hand, several empirical studies find that trade openness (export plus import relative to GDP) has a positive effect on government size (see the discussion in Section 1.2.2). The two prominent explanations are the risk compensation hypothesis and the terms of trade effect (TOTE). Rodrik (1998) explains, governments have to increase transfers in open economies because they have to compensate for the external risks. The TOTE may be illustrated as follows.[1] Since the public sector has a stronger home bias than the private sector, a shift from private to public expenditure increases the demand for domestic goods. This public expansion raises the scarcity of domestic goods and a rise of export prices relative to the import prices. This dampens the costs of public expansion for domestic consumers since foreign consumers share some of the burden by the changed terms of trade. This effect is stronger if the elasticity of substitution between domestic and foreign goods is

[1]The terms of trade effect is discussed by van der Ploeg (1987), Turnovsky (1988), Devereux (1991), Anderson et al. (1996) and Epifani and Gancia (2009).

low. Epifani and Gancia (2009) provide empirical evidence for the TOTE. That is, the positive effect of trade openness on the share of government consumption is conditional on a low elasticity of substitution.

A new theoretical channel, the love of variety effect (LOVE), was highlighted in Chapter 2. It results from intraindustry trade with differentiated goods as modeled in the Dixit-Stiglitz-Krugman framework. If the public sector produces a consumption good and employs the same resources as the private sector, an important cost of the public sector is its negative effect on the number of firms. However, when goods markets are integrated, consumers have also access to foreign varieties. Therefore, the national costs of public good provision in terms of utility are lower and optimal public good provision is higher in open economies than in closed ones. One crucial assumption for this result to hold is that consumers have a love of variety. Almost three decades ago, new trade theory starting with Krugman (1979, 1980) and Ethier (1982) emphasized the importance of gains from trade due to the import of new varieties. It took some time until first empirical studies quantified these gains from variety. Broda and Weinstein (2004) show that new imported varieties on the four-digit level have lowered prices and brought an increase in welfare for many countries (a similar result is provided in Broda and Weinstein (2006) for the United States and more disaggregated trade data). In another study Broda et al. (2006) show that there are productivity gains in various countries arising from new imported products.

The contribution of this chapter is to provide empirical evidence for the LOVE and hence, for the following hypotheses deduced from the theoretical model presented in Chapter 2.[2] First, a broad access to foreign varieties should increase the government share of GDP. Second, if the love of variety is high in a country, the government share should be small. This finding comes from the high costs of public good provision if there is a high love of variety. Moreover, since gains from variety are larger the smaller the country, country size should be negatively correlated with the government share. In addition, the positive effect of imported varieties on government share should be smaller the larger the country.

The measure for the diversity of imports is obtained by counting the different imported

[2]This chapter is based on Hanslin (2010).

products from the rest of the world. In this chapter, a product is defined at the four-digit level of the Standard International Trade Classification (SITC) code, Revision 2, reported in the NBER U.N. trade data by Feenstra et al. (2005). Unfortunately, there is a structural break in reporting trade data in 1984. While for the years 1964 - 1983 each product is reported without considering the trade value, for 1984 - 2000 trade flows below \$100'000 are not reported. Because of data reliability and the aforementioned censoring, the main focus is put on the early OECD sample covering the years from 1964 to 1983.

Estimating panel fixed effect regressions for OECD and non-OECD countries and different time spans, I find strong and very robust results for the LOVE in the early (years 1964 - 1983) non-censored OECD sample. The number of imported products has a positive effect on government consumption as a share of GDP. This positive effect works especially if it is interacted with the share of differentiated[3] in total imported products. Furthermore, the positive effect of new imported varieties on government consumption is decreasing in country size which is in line with the theoretical model. In addition, the share of differentiated products in imports affects government consumption negatively. I use the share of differentiated products in imports as a proxy for the share of differentiated products in the consumption basket which is assumed to be positively correlated with the love of variety. Therefore, costs of public good provision are high and government consumption low if the share of differentiated imports is high.

The chapter is organized as follows. Section 3.1 presents a simple version of the theoretical model described in Chapter 2 from which five testable implications are derived. Section 3.2 describes the empirical model and the data. Section 3.3 presents the main results and Section 3.4 provides robustness checks. Section 3.5 concludes. All the tables of the regression results are reported in Appendix 3.6.

3.1 Theoretical Model

This section presents a simple version of chapter 2 in order to focus on the main implications of the model and to highlight the hypotheses which I am going to test empirically. Compared to Chapter 2 the main simplification is that labor is the only factor of produc-

[3]According to the classification by Rauch (1999).

tion. There is no capital. Apart from simplification, this sharpens the focus on the LOVE. For the sake of readability, I repeat all basic features of the model as well as important results and intuitions. For technical details and derivations, however, I refer to Chapter 2.

There are two countries, home (H) and foreign (F), which differ in the amount of labor endowment (country size). In each country there is a private and a public sector, both producing consumption goods. The public sector employs a share g_i ($i = H, F$) of labor endowment $\bar{L}_i$ and produces the non-traded public good according to a linear production function, $G_i = g_i \bar{L}_i$. The representative household's income is given by $w_i \bar{L}_i$, where w_i denotes the wage rate in country i. Net income - income available for consumption of private goods - is given by $I_i := w_i \bar{L}_i - T_i$, where $T_i = g_i w_i \bar{L}_i$ is the tax imposed by the government. The private sector is characterized by a continuum of industries of measure 1 indexed by $j \in [0, 1]$. In each industry and in each country various firms produce differentiated goods under monopolistic competition. Each firm is a monopolist for one variety, after having incurred some fixed cost. There is free market entry, that is, the equilibrium number of firms in an industry is endogenously determined. I assume free trade between the two countries in an exogenous fraction of industries $\tau \in [0, 1]$ and no trade for the remaining fraction $1 - \tau$. Without loss of generality I refer to trading industries with index $j \leq \tau$ and to the non-trading industries with index $j > \tau$.

The representative household derives utility from consumption of different varieties in each industry and the domestic public good G. Household's preferences for private goods versus the public good is captured in the parameter $\eta \in (0, 1)$.

$$U_i = \eta \int_0^1 \log [Y_{ij}] \, dj + (1 - \eta) \log [G_i] \quad for \quad i = H, F \tag{3.1}$$

where subutility Y_{ij} is a CES aggregator of the varieties consumed in industry j

$$Y_{ij} = \left(\int_{k \in \mathcal{N}_{ij}} \left(y_{kj}^i \right)^\nu dk \right)^{\frac{1}{\nu}}, \quad i = H, F, \tag{3.2}$$

with $\nu \in (0, 1)$. $\mathcal{N}_{ij}$ is the index set of all varieties from industry j which are available in country i and y_{kj}^i denotes consumption of variety k from industry j by the representative

household in country i. The elasticity of substitution between any two varieties from industry j is given by $\sigma = \frac{1}{1-\nu}$. The assumption $\nu \in (0,1)$ implies that $\sigma > 1$ and that the household has a love of variety. Within any industry $j > \tau$, the household can only consume varieties produced in the own country, within an industry $j \leq \tau$, the household consumes all varieties produced in both countries. An increase in τ implies broader access to foreign varieties and, because of love of variety, an increase in utility. Since the elasticity of substitution between the subutilities Y_{ij} is equal to 1, the household allocates net income equally among all industries. Moreover, since the measure of all industries is equal to 1, expenditures per industry equal net income I_i.

Each firm in an industry produces one variety with labor according to the following production function with increasing returns to scale

$$x_{kj} = \begin{cases} A(L_{kj} - L^*) & \text{if } L_{kj} \geq L^* \\ 0 & \text{otherwise} \end{cases} \tag{3.3}$$

where x_{kj} denotes output of firm k in industry j located in country H or F. L_{kj} is the labor input of an individual firm, A denotes labor productivity and L^* the overhead labor needed to run the plant. Because of the fix cost the firms have an incentive to specialize and the number of firms (n_i) equals the number of varieties. The assumption of monopolistic competition with free firm entry within each industry implies for the price and quantity of each variety, and the number of firms

$$p = \frac{w}{A\nu}\,, \quad x = \frac{AL^*\nu}{(1-\nu)}\,, \quad n_i = \frac{(1-g_i)\bar{L}_i}{L^*}(1-\nu)\,, \tag{3.4}$$

respectively.[4] Because firms are identical and countries differ only in country size and government share, output per firm x and price p are equal for all firms and independent of country of production.[5] The government employs $g_i\bar{L}_i$ for public good production and $(1-g_i)\bar{L}_i$ remains available for production of private goods. The price p and the

[4] As we have seen in Chapter 2, n_i is the average number of firms per country, the number of firms per non-tradable industry and the average number of firms in tradable industries.

[5] Note that all considerations in Chapter 2 about demand, goods market, trade account and subutilities are independent of the technology assumption and remain valid in this simplified setting. Wages are equal between the two countries since $\frac{p_H}{p_F} = \left(\frac{x_F}{x_H}\right)^{\frac{1}{\sigma}}$ holds in equilibrium.

quantity per firm x are independent of government activity and equalized between the two countries. However, the number of firms varies with country size. Moreover, since the endowment left for the private sector is decisive for the number of firms in the market, an expansion of the public sector reduces the number of active firms.[6]

In order to determine optimal public good provision the indirect utility of the representative household is maximized. The government share in the foreign country is taken as given.

$$\max_{g_i} \quad \eta\tau \log\left[Y_{i,j\leq\tau}(g_i, g_{i'})\right] + \eta(1-\tau)\log\left[Y_{i,j>\tau}(g_i)\right] + (1-\eta)\log\left[G_i(g_i)\right] \ . \tag{3.5}$$

s.t.

$$\begin{aligned} Y_{i,j>\tau}(g_i) &= \left(n_i(g_i)\right)^{\frac{1}{\nu}} x \\ Y_{i,j\leq\tau}(g_i, g_{i'}) &= \left(\tfrac{I_i(g_i)+I_{i'}(g_{i'})}{I_i(g_i)}\right)^{\frac{1-\nu}{\nu}} Y_{i,j>\tau}(g_i) \end{aligned} \tag{3.6}$$

where $I_i(g_i) = n_i(g_i)px$. This optimization problem results in the following first order conditions:

$$\underbrace{\eta\tau\frac{1-\nu}{\nu}\left(\frac{1}{1-g_i} - \frac{1}{1-g_i+(1-g_{i'})\bar{L}_{i'}/\bar{L}_i}\right)}_{>0}\underbrace{-\frac{\eta}{\nu}\frac{1}{1-g_i}}_{<0} + \underbrace{(1-\eta)\frac{1}{g_i}}_{>0} = 0 \ , \tag{3.7}$$

for $i, i' \in \{H, F\}$ and $i \neq i'$. Note that (3.7) is a special case of (2.22) with $\Omega_{i'} = \frac{\bar{L}_{i'}}{\bar{L}_i}$. So we can recall the economic interpretations from Chapter 2.

The third term in equation (3.7) represents the positive marginal utility of a higher supply of the public good. The second term represents the marginal utility loss due to the crowding out of private firms in tradable and non-tradable industries. The first bracket is positive and dampens the negative effect of the second term. This positive effect comes from the fact that domestic public good production affects only the number of domestic firms - not the number of available foreign varieties. Since households have a love of variety, subutility in open industries is higher than in closed ones. Due to the crowding out of domestic firms, the number of domestic relative to foreign varieties decreases which increases the relative utility gain in open industries. The dampening effect (first term in (3.7)) is larger the more varieties the country imports (measured by τ). Furthermore, it

[6]Note that there are no terms of trade effects.

is larger if the love of variety is stronger or the country is smaller.

Since households have a love of variety ($\nu < 1$), an increase in τ reduces the national cost of public good provision. For instance, a decontrol of protected industries or new technologies which make trade in certain industries feasible may be reflected in an increase in τ. An opening of industries enables access to new varieties and therefore, households' utility increases. Moreover, the crowding out of firms by public good provision hurts less since foreign varieties are available over a larger range of industries.

According to equation (3.7) we can conclude that costs of public good provision are low if the country imports a lot of different varieties (τ large), if love of variety is low (ν large) and the country is relatively small ($\bar{L}_i$ low). Since the share of government consumption is higher the smaller the national costs of public good provision, the following holds (applying the implicit function theorem to equation (3.7)):[7]

$$\frac{\partial g_i}{\partial \tau} > 0 \,, \qquad \frac{\partial g_i}{\partial \nu} > 0 \,, \qquad \frac{\partial g_i}{\partial \bar{L}_i} < 0 \,. \tag{3.8}$$

Furthermore, the larger the country, the smaller the gains from imported varieties:

$$\frac{\partial^2 g_i}{\partial \tau \partial \bar{L}_i} < 0 \,. \tag{3.9}$$

The remainder of this chapter is devoted to the empirical analysis of the model's main results.

3.2 Econometric Model and Data

The empirical work attempts to provide evidence on the following hypotheses:

(I) *The number of imported products has a positive effect on the government share.*

(II) *The positive effect of imported products on the government share is decreasing in the country size.*

(III) *A high share of differentiated products in imports implies a low government share.*

[7] The derivations are given in Chapter 2.

(IV) *The interaction term between the number of imported products and differentiated products has a positive effect on the government share, while the direct effect of hypothesis (I) should decrease.*

(V) *A high GDP implies a low government share.*

While hypotheses (I), (II) and (V) should be intuitively clear, hypothesis (III) and (IV) require an explanation. I argue that the composition of the consumption basket and therefore also the composition of the imported products provide information for the country's preferences. If the share of differentiated products on total imported products is large, households value differentiated goods more. As a consequence the love of variety (LOV) is high (i.e. ν is low in the model). The theoretical model predicts that LOV has a negative effect on the government share because of higher costs of public good provision ($\frac{\partial g_i}{\partial \nu} > 0$, according to (3.8)). Therefore, we should observe a negative correlation between the share of differentiated imports and the government share. This motivates hypothesis (III). Hypothesis (IV) accounts for the fact that LOV is crucial for the positive effect of the number of imported products on the government share.

In view of the aforementioned hypotheses the following equation is estimated.

$$\begin{aligned} g_{it} =& \beta_1 importdiv_{it} + \beta_2 \left(importdiv_{it} \times loggdp_{it}\right) + \\ & \beta_3 diff_{it} + \beta_4 \left(importdiv_{it} \times diff_{it}\right) + \\ & \beta_5 loggdp_{it} + \boldsymbol{\beta_6'} \boldsymbol{X_{it}} + \eta_t + \mu_i + \epsilon_{it} \end{aligned} \tag{3.10}$$

where i indexes countries, t indexes time, g_{it} denotes government consumption as a log share of GDP, $importdiv_{it}$ is the number of different imported products (normalized), $diff_{it}$ is the share of differentiated products on total imported products, $loggdp$ is log of GDP, other time varying potential covariates are included in the $k \times 1$ vector $\boldsymbol{X_{it}}$ (k is the number of controls which are described below), β_i, $i = 1, ..., 5$ and the $k \times 1$ vector β_6 are the parameters to be estimated, η_t are time fixed effects (controls for global shocks), μ_i denotes country fixed effects (controls for time-invariant omitted-variable bias) and ϵ_{it} is the idiosyncratic error term.

The data are drawn from various sources. Following the previous studies on openness and government spending, as for instance Rodrik (1998) and Epifani and Gancia (2009),

the measure for government size (g) is government consumption as a share of GDP from Heston et al. (2006) (Penn World Tables 6.2, henceforth PWT).[8] Figure 3.1 plots the unweighted sample means of the share of government consumption over time for OECD[9] and non-OECD countries separately. A few things stand out. The share of government consumption is much lower in the OECD subsample. The peak around 1993 in the OECD subsample is due to Czech Republic, Hungary, Poland and Slovak Republic. The jump in 1970 in the non-OECD sample is mainly due to the high government share of countries for which data for government spending is only available since 1970.[10]

In this chapter a product is defined on the four-digit level. The measure for import diversity (*importdiv*) used in this empirical part is the number of different imported products from the rest of the world, normalized by the sum of all traded products in the world between 1964 and 2000.[11] Let $J_{it}^{j} = 1$ if country i imports a strictly positive amount of product j in year t and zero otherwise.

$$importdiv_{it} = \frac{\sum_j J_{it}^j}{\sum_i \sum_t \sum_j J_{it}^j}$$

where the denominator is equal to 1069 for the time period 1964 to 2000. The data source for the measure of import diversity is the NBER U.N. trade data by Feenstra et al. (2005) where imports and exports are reported in the Standard International Trade Classification (SITC) code, revision 2, at the four-digit level. The disadvantage of these less disaggregate four-digit trade flows is that the increase in the number of varieties is underestimated. However, since I am primarily interested in providing evidence for the LOVE, I am more concerned about qualitative than quantitative effects. The advantage of the four-digit data is its insensitiveness against false increases due to splitting of product

[8] According to Rodrik (1998) this measure includes only government consumption and neither public investments nor income transfers.

[9] From the OECD sample Luxembourg is dropped since trade data are only available for Belgium-Luxembourg. We treat Luxembourg as negligibly small and assign the combined information to Belgium. Results are robust concerning the exclusion of Belgium. The observations of Norway for the second period are dropped since the trade data show a curious pattern (extreme outliers in some years). Results are also robust if Czech and Slovak Republic are excluded.

[10] Note that the data includes expenses for defense. Therefore, the econometric analysis will control for an index which measures the involvement in wars.

[11] The reason for this normalization is to obtain a measure between zero and one. $importdiv = 1$ implies that a country imports each four-digit product which has been traded at least once between 1964 and 2000 between any two countries.

categories and "replaced" products due to technological progress. Endogeneity might not be a big issue in this case since variation on four-digit level are driven rather through trade liberalization than changes in demand (see Kehoe and Ruhl (2009)). Moreover, goods on this aggregate level are more differentiated. As a result, consumption of an additional variety brings about larger gains.[12]

The share of differentiated imported products is computed using Rauch's (1999) liberal classification.[13] Rauch (1999) divides commodities into three categories: Differentiated goods, reference priced goods and goods traded on organized exchanges.[14] According to Rauch (1999): *"Possession of a reference price distinguishes homogeneous from differentiated products. Homogeneous commodities can be further divided into those whose reference prices are quoted on organized exchanges and those whose reference prices are quoted only in trade publications"* (p. 10).[15] Broda and Weinstein (2006) provide estimations of the elasticity of substitution for the three commodity groups which are summarized in table 3.19 (Appendix 3.7). They find that the average elasticity of substitution of goods classified as differentiated is much lower than the one of goods traded on organized exchange. Goods classified as reference priced have (on average) a slightly higher elasticity of substitution than differentiated goods and a much lower elasticity than goods traded on organized exchange. Therefore, countries with a large share of differentiated goods have on average a lower elasticity of substitution. Based on these elasticities, it is not obvious that one should focus on the group of differentiated goods only. One can argue that the group classified as differentiated captures too few differentiated goods. However, the group of reference priced goods is quite heterogeneous regarding the estimated elasticities and may contain a too broad set of goods. Nevertheless, since the difference between the average elasticity of substitution of reference priced goods and differentiated goods

[12]The distribution over time of the diversity measure is provided in figure 3.2.

[13]Rauch (1999) distinguishes between the liberal and conservative measure. He writes: *"Because ambiguities arose that were sometimes sufficiently important to affect the classification at the [...] four-digit level, both 'conservative' and 'liberal' classifications were made, with the former minimizing the number of [...] four-digit commodities that are classified as either organized exchange or reference priced and the latter maximizing those numbers"* (p. 15).

[14]The shares of four-digit products falling into these liberal classifications are 55%, 28% and 18% respectively.

[15]Examples of differentiated goods are (separated by ;): newspapers journals, periodicals; spectacles and spectacle frames; footwear; blouses of textile fabrics; telecommunications equipment; cutlery; woven fabrics; fresh or dried figs; non alcoholic beverages; etc. Reference priced goods are, for instance: fresh milk and cream; frozen fish fillet; fresh apples; natural honey; cigarettes; electric current; etc.

is very small, I distinguish between two measures for the share of differentiated imports. The restrictive measure $diff_r$ stands for the share of differentiated commodities while the liberal measure $diff_l$ for the share of differentiated goods plus the share of reference priced goods. Formally, we have:

$$diff_r = \frac{\sum_j d^j J^j_{it}}{\sum_j J^j_{it}}$$
$$diff_l = \frac{\sum_j (d^j J^j_{it} + r^j J^j_{it})}{\sum_j J^j_{it}}$$

where $d^j = 1$ ($r^j = 1$) if product j is classified by Rauch as differentiated (reference priced) and equal to zero otherwise. Figure 3.3 plots the distributions of the two measures over time.

The variable *loggdp* is the log of real GDP in purchasing power parity (PPP) dollars at 2000 prices (Laspeyres) which is drawn from PWT. Other variables drawn from PWT are population and the widely used measure for trade openness which is export plus import as a share of real GDP in constant prices. Following the previous literature trade openness is lagged one period to reduce the endogeneity problem. Both variables are logarithmized and in the following referred to *logpop* and *lagopenness*. Further potential covariates which are controlled for are the political regime (*polity2* from the Polity IV dataset), dependency ratio (*depend*) to control for demographic characteristics, urbanization rate (*urban*) and whether the country was affected by or involved in violence and wars (*war*). The *polity2* is a composite policy index which ranges from -10 (hereditary monarchy) to 10 (consolidated democracy). It is the difference between the Polity Democracy index and the Polity Autocracy index (both ranging from zero to ten). The dependency ratio, which is the share of population below 15 and beyond 64, relative to the population between 15 and 64, is constructed using World Development Indicators from the World Bank (henceforth WDI). The urbanization rate (the share of population living in urban areas) is also drawn from WDI. The measure for violence/war is ACTOTAL from Major Episodes of Political Violence (MEPV) and conflict regions which ranges from zero (no violence) to ten. This composite index consists of international violence and war, civil violence and war and ethnic violence and war. A detailed list of sources and definitions

for each variable is provided in table 3.1 (Appendix 3.6).

The unbalanced panel data covers 156 countries (the full list is reported in Appendix 3.7, table 3.20) and the years 1964 - 2000. As already mentioned above, there is a change in reporting trade flows in the World Trade Data between 1983 and 1984. After 1984 trade flows below \$100'000 per year were not reported in the original data from United Nations. However, Feenstra et al. (2005) indicate that some adjustments had been made for these low valued trade flows. This break can be seen clearly in figure 3.2, where the distribution of the variable *importdiv* is plotted over time. The difference between the OECD and non-OECD countries is distinct. While the sample average among OECD increased after 1983 it dropped for non-OECD. Furthermore, the distribution for non-OECD after 1983 is much broader than it is before, especially there is a much longer tail at the bottom. This indicates that for many developing countries a lot of low valued trade flows were not reported and therefore, the number of imported varieties is underestimated for many countries.[16] The distribution for the OECD sample has increased only slightly. The reason for this upward jump may lie in the different data source. If this structural break in *importdiv* is only a level effect we control for it with the inclusion of time dummies. However, figure 3.2 suggests that it seems wise to look at the different time periods and country sample separately.

All variables are computed as four year averages, except the last period which covers five years.[17] Hence, there are five periods from 1964 until 1983 and four periods from 1984 to 2000. Averaging helps to smooth cyclical variations that are likely to be present in yearly data. Table 3.2 provides descriptive statistics (sample means, standard deviations and extreme values) of the variables, separately for OECD and non-OECD and the two time periods.

[16] A further reason for the underestimation of the number of imported goods might be that after 1984 there are only 72 reporting countries. For the non-reporting countries import data is only available through the export information of the reporting countries.

[17] The results are similar if yearly data are taken. Results are only reported for the early OECD sample (discussion in Section 3.4).

3.3 Regressions

According to the hypotheses we have the following predictions on the coefficients in equation (3.10). We expect β_1 to be positive if we do not include the interaction term $importdiv \times diff$. If we include the interaction term, β_1 should not be significantly different from zero while β_4 should be positively significant. The reason is, that import of new varieties does only bring gains from trade if the goods are differentiated. And the more so, the more differentiated the varieties. β_2 is expected to be negative, since the gains from variety should decrease in the country size.[18] The sign of β_3 is also expected to be negative. As argued, a high share of differentiated goods in the import basket implies that differentiated varieties are more important for the consumer, indicating a higher love of variety. A high love of variety implies that there are high national cost of public good provision. The parameter for market size, *loggdp*, is expected to be negative. Because of the interaction term of GDP with the diversity of imports, β_5 might also become insignificant as the parameter β_2 captures the lower gains from trade if the country is larger.

These aforementioned variables are highlighted (printed in bold-face type) in the regression-output as they are the variables I am interested in most. In all regressions, the fixed effect estimator is used (to control for time invariant unobserved country characteristics) and standard errors are robust (i.e., standard errors are heteroskedasticity-consistent).[19]

The analysis starts with a baseline regression of pooling all countries and time periods. The main focus, however, lies on the OECD country sample with special weight on the first period where data quality is best (no censoring of trade data).

[18] Existing theories about how country size may affect the share of government consumption is manifold. Assuming that the public good is a normal good we should expect it to increase with GDP. According to Wagner's law the government share should increase as the economy develops. According to Alesina and Spolaore (1997) larger countries have a smaller government share due to economies of scale in public good provision. Empirical evidence for these hypotheses is given in Alesina and Wacziarg (1998) where it is shown that the share of government consumption is smaller in larger countries and that small countries tend to be more open to trade.

[19] The random effects estimator might be an alternative to the fixed effects estimator. However, random effects estimator is only consistent if country-specific effects are uncorrelated with the other explanatory variables (see e.g., Hayashi, 2000, pp. 330-335) which is unlikely the case in such country data. The Hausman test rejects the random effects estimator.

3.3.1 Baseline Regression

Table 3.4 presents regression results for the whole country sample. In addition to time dummies, the dummy variable *oecd*×*after84* allows for different structural breaks between the two country groups (as suggested by figure 3.2). Further, in all columns I control for level of development and country size, that is log GDP and log population.[20] Log GDP is negatively and log of population positively significant, implying that log of GDP per capita has a negative effect.

In the first column the number of imported varieties is insignificantly different from zero. Including the interaction term of *importdiv* with log GDP in column (2), increases the effect of *importdiv* to 1.9 while the interaction term has a negative effect. Both variables are significant at the 1% level. The interpretation of this result is in line of the above constructed hypotheses. An increase in the number of imported varieties increases the government share. This increase is lower, the larger the country. In columns (3) and (5), the shares of differentiated imports (the restrictive and liberal measure respectively) is included controlling for the love of variety. In both columns the respective coefficient is negative and significant at the 5% and 10% level respectively. The negative sign is also in line with the theoretical model and the hypothesis mentioned above. Further, in columns (4) and (6) the interaction term of *importdiv* with $diff_r$ and $diff_l$ respectively is included. Against the hypothesis the interaction terms are negative. However, the coefficient of *importdiv* increases from 1.9 (2.1) to 4.4 (6.0) compensating the negative effect of the interaction term. In sum, the effect of an increase in *importdiv* is still positive. Note that the interaction terms are highly correlated with the variable *importdiv*. The interaction terms are interesting from a theoretical point of view. Empirically, however, it may incorporate some problems of multicollinearity.[21] If two variables are highly correlated, the standard errors can become very large and the estimates insignificant. This is not the case here. Also, small changes in the data can change the estimated coefficients heavily.

Table 3.5 shows the results with a full set of control variables. The results of the main measures of interest do not change qualitatively. Similar to the findings of others

[20]Note that since GDP and population enter in logs, controlling for log GDP per capita is redundant.

[21]The correlation is greater than 0.9 between *importdiv* and *importdiv* × *diff* and between *importdiv* and *importdiv* × *loggdp*. The correlation of some important variables for the early OECD sample are given in table 3.3.

(e.g., Rodrik, 1998; Alesina and Wacziarg, 1998; Epifani and Gancia, 2009) *lagopenness* is significantly positive. The variables *polity*2, *depend* and *urban* are not significantly different from zero. The violence/war index (*war*) is positively correlated with the share of government consumption.

Table 3.4 and 3.5 report the baseline regression including OECD and non-OECD countries. However, the data within and between these two country groups differ substantially. It is apparent from figure 3.2 that not only the pattern over time for the number of imported products is very different for the two country samples, but also that within group heterogeneity is much higher in the non-OECD sample. It might be sensible to look at the two country groups separately. Since the OECD country group is much more homogeneous and, on average, data is more reliable, the following analysis gives special weight to the OECD countries.

3.3.2 OECD

Table 3.6 reports a first set of regressions for the OECD sample including some selected control variables. In order to control for the jump in the trade data in 1984, time dummies are included in each regression. In columns (1) to (5), the main measures of interest have mostly the expected sign according to the hypotheses derived from the model. In column (7) *importdiv* gets negatively significant at the 5% level. In sum however, the effect of an increase in *importdiv* is still positive for the average country. Excluding *importdiv* (columns (6) and (8)) does not alter the main message but reduces the problem of multicollinearity and lowers the standard errors. This is the case since the number of imported varieties is highly correlated with the number of differentiated imported varieties. While in table 3.6 the main variables and the interaction terms are successively introduced for a given set of controls, table 3.7 tests the robustness of the main variables' estimates when the set of controls varies. As table 3.7 shows, the results of the variables in bold (except *loggdp*) are not robust and depend heavily on the chosen set of controls. According to this table, there is only support for the hypotheses under certain set of controls. Later on it is shown that results stay more robust when fixed effects are different for the two periods.

In contrast to the finding of many authors who find a positive effect of trade openness (export plus import as a share of GDP) on government size, we do not find this effect for OECD countries (in line with Garrett and Mitchell (2001)). For OECD countries lagged trade openness is negatively significant at the 1% level.[22] Since in table 3.5 lagged openness is positive and in table 3.6 negative, the positive effect of *openness* on government size is driven by non-OECD countries.

How we should deal with the structural break in the explanatory variables is not that obvious. Including time dummies is clearly a necessary procedure. However, if the change in reporting trade is country specific, the country fixed effect in the early period differs from the one in the second period. The tables 3.8 and 3.9 report the results if we allow the country fixed effect to change between the two periods.[23] This procedure doubles the number of groups. A country's data before and after 1984 are considered as observations from two different countries. However, standard errors are clustered by country. An argument for a change in country fixed effects might be that censoring trade flows below $100'000 affects small and large countries differently. Table 3.8 does not control for additional covariates. In contrast to table 3.6 and 3.7 *loggdp* is no more significantly negative. Column (2) in table 3.8 implies that an increase of import variety has a positive effect on government consumption for the average country.[24] However, for large countries the overall effect would be negative. In column (4), $diff_r$ and the interaction term $importdiv \times diff_r$ are included. The variable *importdiv* gets insignificant and the interaction term is positive and highly significant. This means that the positive effect of imported varieties works especially if goods are differentiated. This confirms our hypothesis. Moreover, also in line with the theoretical prediction, if the share of

[22] Rodrik (1998) already found the different pattern between richer and poorer countries. He argues that the positive relation between trade openness and government spending is due to the external risk. According to Rodrik (1998) developed countries react with an increase in public employment and work programs, which is reflected in an increase in government consumption. However, developed countries have social welfare programs. Since social security is not included in the measure for government consumption from PWT, we should not necessarily find an effect there.

[23] Consider a fixed effects estimation of $y_{it} = \beta x_{it} + c_i + D_{84} + u_{it}$, where D_{84} is a dummy equal to zero for the first period and equal to one for the second period and c_i is a country fixed effect. It follows that $E(y_{it}|\beta x_{it}, c_i, D_{84}) = \beta x_{it} + c_i + D_{84}$. If a structural break in the explanatory variable x_{it} is country specific, D_{84} insufficiently accounts for the break in x_{it}. In order to account correctly for country specific breaks, the country fixed effects should be interacted with the period dummy.

[24] We have $\frac{\partial g}{\partial importdiv} = 12.824 - 0.638 \times loggdp$. Hence, for the average country ($loggdp \approx 19$) $\frac{\partial g}{\partial importdiv} = 0.7$. For the largest country ($loggdp = 22.92$) we obtain $\frac{\partial g}{\partial importdiv} \approx -1.8$.

differentiated goods in the imported good basket increases, i.e. love of variety increases, government consumption decreases. Columns (6) and (7) show the same specification as in (3) and (4) with $diff_l$ instead of $diff_r$. Columns (5) and (8) report the results excluding *importdiv* since the number of imported goods and the number of differentiated imported goods are highly correlated. If we compare column (4) with (5) and (7) with (8) it can be observed that the standard errors mostly decrease fairly strongly. Generally it can be said that for the average country the number of imported products has a positive effect on the government share.

The estimation is quite robust with respect to the inclusion of further controls (table 3.9). The effects are slightly attenuated but mostly keep their expected sign and do not lose significance. In column (4) *importdiv* is still positively significant (at 5% level), despite the inclusion of the interaction term $importdiv \times diff_r$. One can argue that there are still differentiated products captured in *importdiv* since $diff_r$ does not take into account all differentiated products. In column (8) *importdiv* gets negatively significant, correcting for what $importdiv \times diff_l$ overstates the effect of differentiated imported varieties. In order to reduce the problem of multicollinearity, columns (5), (6), (9) and (10) exclude *importdiv*. The estimation of the number of differentiated imported varieties in column (5) is much higher than the coefficient for *importdiv* in column (3). Interestingly, controlling for *lagopenness* (compare (5) with (6) and (9) with (10)) increases the estimated coefficients of the variables in bold and reduces their standard errors. Comparing the interaction term $importdiv \times loggdp$ and *diff* in table 3.6 and 3.7 with tables 3.8 and 3.9, the specification which allows fixed effects to be different for the two periods yields much more robust results with respect to the inclusion of controls.

To see whether the evidence for the love of variety effect we have found so far are robust, I now split the sample in two subperiods. The sources of trade data for the two periods are different and low valued trade flows below $100'000 are not reported in the later period. In the early sample no censoring has taken place. A closer look on the early sample seems appropriate. Tables 3.10 to 3.12 provide estimation results for the OECD sample and the period from 1964 to 1983. In table 3.10 results without further controls are shown. The estimated coefficients are quite similar to the regression in table 3.8. The results are robust with respect to further controls as it can be seen in table 3.11. While

in column (3) *importdiv* is significant at the 5% level, *importdiv* is not significant in column (7). We may argue that the interaction term *importdiv* × $diff_r$ does not capture all differentiated products and therefore *importdiv* stays significant. Since $diff_l$ is a less restrictive measure of differentiated products, *importdiv* × $diff_l$ captures a broader set of differentiated imports. According to column (3) the effect of *importdiv* on the share of government consumption is positive for the average country and equal to 0.45.[25] As g is in logs, an increase in *importdiv* of 1 percentage point (say from 0.5 to 0.51) - which is an increase of approximately 11 new imported products - implies that the government share increases by 0.45 percent. For the smallest country (with $loggdp = 14.56$) the effect is even 2.78.

As columns (4) and (8) show, the inclusion of additional controls (the diversity of exports (*exportdiv*) and the volume of imports (*imports*)) does not change sign and significance of the coefficients of interest. Both variables could potentially be correlated with government size and the number of imported products.[26] When a country's production is concentrated on a few industries (this might be reflected in a smaller range of exported products) the range of imported goods may be larger. Further, the number of imported varieties and the volume of imports are positively correlated, the effect of import diversity on government spending could just capture the effect of higher import volumes. Accounting for import volume (*imports*) indicates that this concern is unfounded.

The interaction term *importdiv*×$diff_r$ represents the number of differentiated imported goods. So far *importdiv* × $diff_r$ and *importdiv* have been included in order to show that the number of differentiated imported goods are more important than the number of all imported goods. As the two are highly correlated, table 3.12 provides the results without *importdiv*. The results show that, without the interaction term *importdiv* × *loggdp*, the effect of the number of differentiated imported goods is positive but only weakly significant when we do not control for *lagopenness* (column (1)). Introducing *lagopenness* as a further control reduces the effect of the number of differentiated imported products which is still positive but not significant (column (2)). A robust result is that

[25] Note that $\frac{\partial g}{\partial importdiv} = 5.493 - 0.532 \times loggdp + 9.863 \times diff_r = 0.45$ if $loggdp = 18.93$ and $diff_r = 0.51$.

[26] Cameron (1978) argues that countries where production is concentrated on few industries are stronger hit by external shocks. When government provides insurance against these risks, the government share is larger when industries are concentrated.

a high love of variety ($diff_r$) reduces the share of government consumption. In column 3, the interaction term $importdiv \times loggdp$ is significantly negative while the number of differentiated imported goods is positive and highly significant. The positive effect of additional imported goods is decreasing in home market size.

The findings for the late OECD sample are provided in table 3.13. Columns (1) to (4) indicate that the number of imported varieties has a positive effect on the government share ($importdiv$ and $importdiv \times diff_r$ are positively significant). Moreover, the effect is stronger if the imported goods are differentiated. The first four columns also show that the government share decreases in home market size ($loggdp$). Columns (5) to (7) test the other hypotheses. However, the estimated coefficients and standard errors are quite large which is probably the result of the high correlation between the levels and interaction terms.

To sum up the results on OECD countries, we can say that we find the expected signs according to the hypotheses in almost all of the specifications. Hence, the results are extremely robust and give strong support for the theoretical model. The effect of imported varieties plays a more important role in rising the government share if the imported goods are differentiated: in most regressions $importdiv \times diff$ is highly significant and larger than the effect of $importdiv$. It is impressive that the interaction term $importdiv \times loggdp$ is always negative and mostly highly significant at the 1% level in all regressions in tables 3.8 to 3.12. Also, the share of differentiated imports has mostly a negative and significant effect. Despite the high correlation between some explanatory variables, the estimation is able to identify the effects in most cases. The high correlation seems to be only a problem if one looks at the second period separately.

3.3.3 Non-OECD

Finally, the non-OECD country sample is examined. The data among non-OECD countries is much more volatile. Separate regressions for the two time periods lead to insignificant estimators.[27] The number of observations is too low for the degree of volatility. Therefore, only the results for the whole time span are reported. Analogously to the

[27] Results not reported.

OECD sample the first regression shows the results with constant country fixed effects (table 3.14) and the second allows the country fixed effects to be different between the two periods (table 3.15). According to table 3.14 the number of imported goods has a positive effect on the share of government consumption and the effect is decreasing in country size. In the first column of table 3.15 *importdiv* is significant at the 5% level implying that the government share for countries with a broader set of imported goods is larger. In column (7) the coefficient on the number of differentiated imported products is higher than in column (1) on *importdiv*. This indicates that the effect of imported goods is stronger if they are differentiated. In column (8) the coefficient of $importdiv \times diff_l$ gets closer to the one of *importdiv* in column (1) as the liberal measure comprises a broader set of goods (including less differentiated ones) than the restrictive measure. In the other columns the signs of the coefficients on the variables of interests are in line with the theory, however, not significant.

3.4 Robustness Checks

The results so far give a strong indication that at least OECD data is consistent with the hypotheses - the love of variety effect on government consumption implied by the presented theory. In order to minimize the possibility that the findings above are a coincidence and a consequence of certain specifications, this section presents various robustness checks for the early OECD sample.

Log specification

We should be aware that some functional form is imposed by taking logs and the results may depend on this procedure. For instance, Rodrik (1998) logarithmized all shares and found a positive relationship between lagged openness and government consumption. Alesina and Wacziarg (1998) replicated Rodrik's regression with and without logarithmized government share and with a more or less similar country sample. They find that openness is significantly positive with log ratios, however it is not significant in levels. My motivation of using log government shares comes from the theoretical model in which shares are the decision variables. Solving equation (3.7) for two symmetric countries

($\bar{L}_H = \bar{L}_F$), the shares in both countries is identical and equal to

$$g = \frac{1-\eta}{1+\eta\frac{1-\nu}{\nu}(1-\tau/2)} \ .$$

Taking logs on both sides we obtain

$$\log g = \log(1-\eta) - \log(1+\eta\frac{1-\nu}{\nu}(1-\tau/2)) \ .$$

For realistic values of the elasticity of substitution ($\sigma > 2$, i.e. $\nu > 0.5$) the expression ($\eta\frac{1-\nu}{\nu}(1-\tau/2)$) is small and therefore, the following equation holds approximately:

$$\log g \approx \log(1-\eta) - \eta\frac{1-\nu}{\nu} + \eta\frac{1-\nu}{\nu}\tau/2 \ .$$

However, in view of the different findings depending on taking logs as mentioned above, it is reasonable to check for the robustness of this specification. Table 3.16 provides the results and confirms that the log specification does not drive the results. If we compare the estimations for the variables in bold, they keep their expected sign and are highly significant. Note however, that the coefficient of lagged openness is now insignificantly different from zero while it is significantly negative under the log specification.

Dynamic panel estimation

One may argue that the share of government consumption reacts rather slowly on changes in the economic environment and therefore past realizations of the dependent variable may affect its current level. In order to capture this persistence a lagged value of government consumption is included on the right-hand side of the estimation equation.[28] This is a nice robustness check, however, we should not put too much weight on these results as the number of observations is really small. Table 3.17 shows the results with one-step Arellano and Bond's GMM estimator for the early OECD sample, one lag of government share on the right hand side and first differences in the other variables. It is corrected

[28]To prevent a loss of observations through the introduction of the lag, the first observation for government consumption is the average of 1960-1963.

for heteroskedasticity in the error terms by robust standard errors.[29] This method assumes that there is no second-order autocorrelation in the first-differenced errors. The null hypothesis of first- and second-order autocorrelation in the error terms is rejected. The results show some persistence in government consumption. The coefficient on lagged government share is around 0.3 and significant at the 5% level. Nevertheless, the estimations of the main measures are strongly robust and do not lose their significance. Note, however, that in contrast to table 3.10 *lagopenness* has lost its significance.

Alternative measure for importdiv

Further, an objection might be that only counting the number of different products imported from the rest of the world is biased towards counting too few products. There might also be gains from consuming both German and Italian cars. An alternative to the *importdiv* measure used so far is to distinguish between the countries of origin as well. Columns (1) to (3) in table 3.18 show the results with this alternative measure which counts a good manifold if classified as differentiated by Rauch (1999). For example, the product category "passenger motor cars, for transport of passengers and goods" is classified as differentiated. If a country imports cars from Germany and Italy, the product category "passenger motor cars, for transport of passengers and goods" is counted twice. Finally this new measure is logarithmized.[30] Hence, the coefficient on *importdiv* can be interpreted as an elasticity. According to column (1) a 1% increase in imported varieties implies a 0.026% increase in the share of government consumption for the average country. For the smallest country in the sample, a 1% increase in imported varieties would even increase the share of government consumption by approximately 0.5%. Since this new measure already accounts for differentiated goods, the interaction term $importdiv \times diff$ is, due to a multicollinearity problem, not included in the regression.[31]

[29]The instruments seem to be valid as the Sargan test of over-identifying restrictions of the one-step homoskedastic estimation is not rejected.

[30]The mean of this new measure is equal to 8.36, the standard deviation is 0.51, minimum and maximum are equal to 6.88 and 9.36 respectively (these figures are for the OECD sample and the early period).

[31]If the interaction term $importdiv \times diff$ is included, the estimations of the main variables of interest (in bold) become insignificant.

Alternative measure for diff

Using the share of differentiated imports is one alternative to proxy the love of variety. According to Dixit-Stiglitz, the love of variety is inversely related to the elasticity of substitution. Broda and Weinstein provide an estimation of the elasticity of substitution (see Broda and Weinstein, 2006), which we are going to take into account next. Consider the following inverse of a weighted elasticity of substitution:

$$lov_{it} = \left(s_{it}^d \sigma^d + s_{it}^r \sigma^r + (1 - s_{it}^d - s_{it}^r)\sigma^h\right)^{-1}$$

where s_{it}^d (σ^d) denotes the share (elasticity) of differentiated goods and s_{it}^r (σ^r) the share (elasticity) of reference priced goods and σ^h the elasticity of homogeneous goods. For the elasticity of substitution, the average of the two periods provided by Broda and Weinstein (2006) (see table 3.19) is taken, that is $\sigma^d = 4.95$, $\sigma^r = 6.85$ and $\sigma^h = 13.45$. As we expect, the correlations between the two *diff* measures and *lov* are very high: $corr(lov, diff_r) = 0.91$ and $corr(lov, diff_l) = 0.89$.

The regression results for this alternative proxy for the love of variety are found in table 3.18 column (4).[32] Again, the results are in line with the hypotheses. While *import-div* is not significantly different from zero, its interaction term with *loggdp* is negatively significant and its interaction term with *lov* is positively significant. The new proxy *lov* itself is negatively significant.

Yearly data

In order to exclude the possibility that the results depend on averaging the data, the last three columns in table 3.18 provide the results with yearly data including all controls. Concerning the significance the results are extremely robust. However, the magnitude of the estimated effects differs slightly if we compare it with the results in table 3.10.[33]

[32]The mean of the variable *lov* is 0.14, the standard error is 0.003.

[33]Results (not reported) are robust if I only take every 4 years. This is suggested by Acemoglu et al. (2008) who prefer to take every 5 years to averaging over 5 years since averaging introduces additional serial correlation.

3.5 Conclusion

The possibility of open countries to export costs of public good provision to foreign countries through the terms of trade effect is well known. Empirical evidence indicates that this channel exists and that open countries have bigger governments because of the terms of trade externality.

Accounting for differentiated goods, love of variety and endogenous firm entry, the theoretical model presented in Chapter 2 has shown a new alternative: the possibility to export costs of public good provision through the variety effect. If the crowding out of firms are important costs of public good provision, access to a broad range of foreign products dampens national costs of public good provision. This chapter provided empirical evidence for this theoretically predicted channel - referred to as the love of variety effect on government spending.

The main focus of the empirical analysis lies on the OECD country sample and the time span 1964-1983 where trade data are not censored. For this sample the results are very robust with respect to the set of controls, log specification, yearly or averaged data. The number of imported varieties has a positive effect on the share of the public sector. This positive effect is mainly driven by goods classified as differentiated. This is what we expect from the theoretical model, since there are only gains from new imported goods when the goods are differentiated. Furthermore, I find that the positive effect of imported varieties decreases in country size. Also this is in line with the theory. The intuition behind this finding is that national costs of public good provision in large countries are dampened relatively less by intraindustry trade. Last but not least the share of differentiated on total imported products is negatively correlated with the government share. The share of differentiated imported products is taken as an indicator for love of variety. National costs of public good provision are large if love of variety is high since crowding out of domestic varieties "hurts" more.

The results show that the data for OECD countries fit quite well the theoretical framework. Some evidence is also found for non-OECD countries. Government consumption share is positively associated with the number of (differentiated) imported goods. However, the evidence with respect to the other hypotheses is less robust than the one for

the OECD countries. In sum, this chapter provides empirical support that there is a new channel for fiscal externalities: the LOVE. Access to foreign varieties due to intraindustry trade dampens the costs of public good provision so that, other things equal, trade liberalization leads to larger governments. Because of the externalities, fiscal cooperation would be necessary to achieve global efficiency.

By focusing on the extensive margin of imports, this chapter provides first evidence on the LOVE. The obtained results show that the LOVE is not negligible. A natural next step is to obtain insights on the relative importance of the terms of trade effect, generated by the government's impact on the intensive margin of trade, versus the love of variety effect, coming through the extensive margin of trade.

3.6 Appendix A

Figure 3.1: Development of government consumption in OECD and non-OECD (unweighted average)

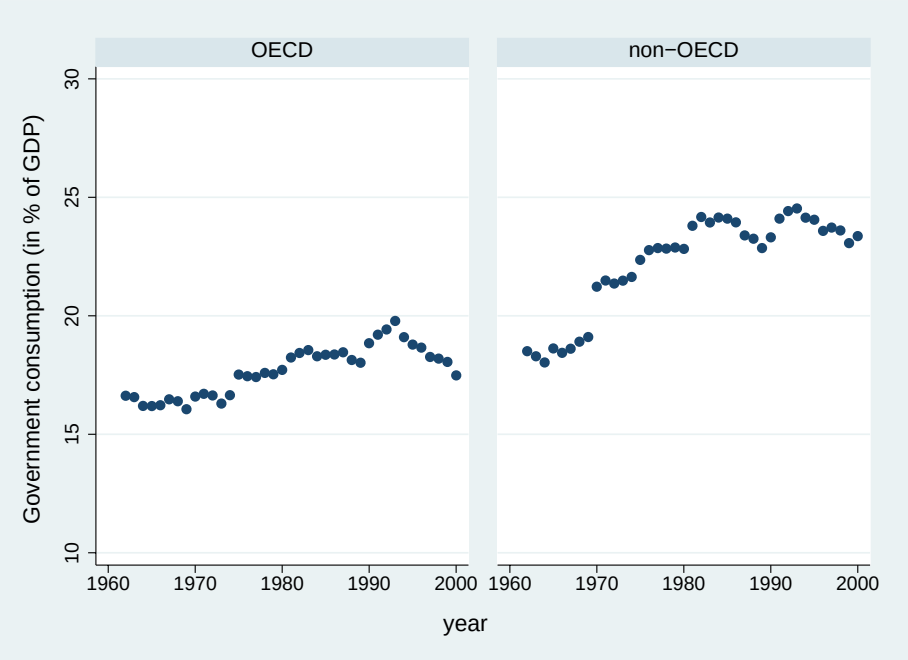
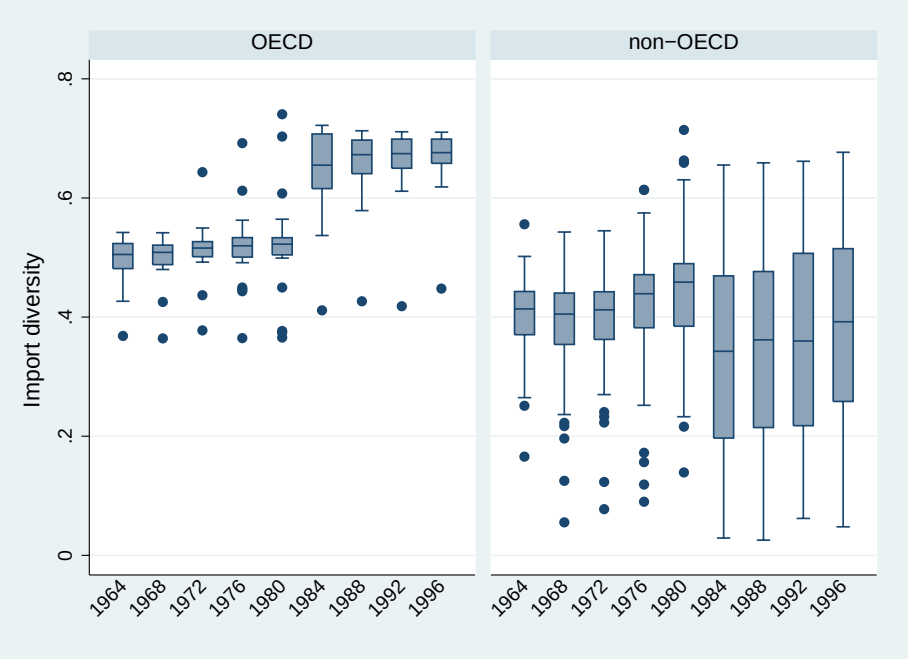
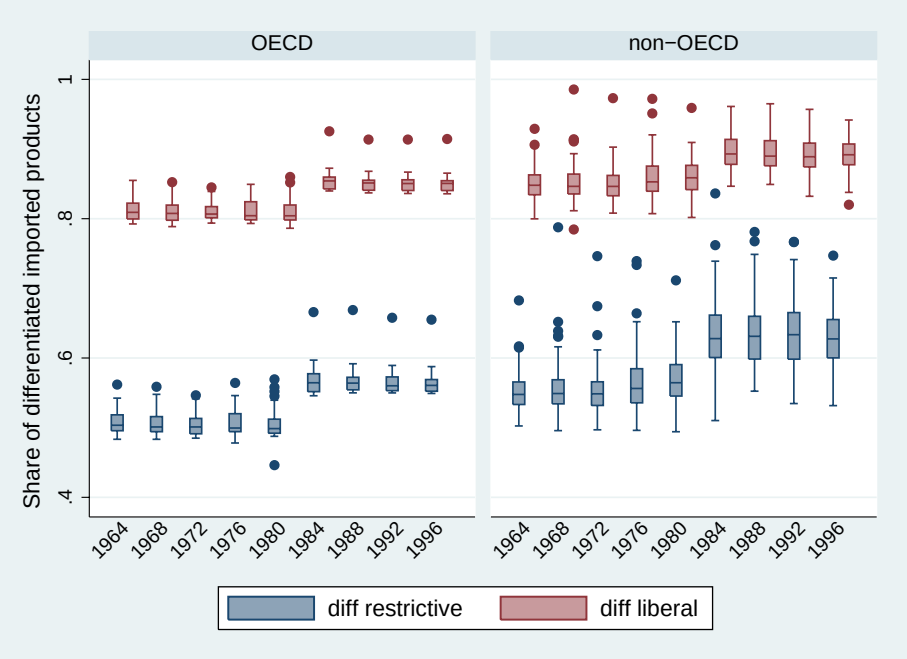


Figure 3.2: Distribution of import diversity in OECD and non-OECD



Notes: 1964 refers to the time period 1964-1967, 1968 to 1968-1971 and so on. 50% of the distribution are within the box, the whiskers and adjacent lines comprise the lower and upper adjacent value and the data points are outlayers. The lowest outlayers within the OECD sample are Turkey (1964 to 1983) and Iceland (1984 to 2000).
Import diversity is the number of imported products divided by 1069 (the total of available product categories).

Figure 3.3: Distribution of the share of differentiated imported products on total imported products in OECD and non-OECD



Notes: diff restrictive refers to the variable $diff_r$ and diff liberal to $diff_l$. The former takes only goods classified as differentiated, the latter combines goods classified as differentiated and reference priced (classifications by Rauch (1999)).

Table 3.1: Data and Sources

Variable	Description	Source
g	log-share of government consumption to real GDP (in %) from Penn World Tables 6.2	http://pwt.econ.upenn.edu/
loggdp	log real GDP (Laspeyeres method in 2000 prices) from Penn World Tables 6.2	http://pwt.econ.upenn.edu/
logpop	log of total population in thousands from Penn World Tables 6.2	http://pwt.econ.upenn.edu/
importdiv	number of different imported 4-digit products (Standard International trade classification, Rev. 2), normalized 0-1	World Trade Data (Feenstra and Lipsey, 2005) http://cid.econ.ucdavis.edu/data/undata/undata.html
$diff_r$	share of differentiated on total imported products	Rauch (1999) and World Trade Data (Feenstra and Lipsey, 2005)
$diff_l$	share of differentiated plus share of reference priced on total imported products	Rauch (1999) and World Trade Data (Feenstra and Lipsey, 2005)
*polity*2	Composite Polity index ranging from -10 (hereditary monarchy) to 10 (consolidated democracy)	http://www.systemicpeace.org/inscr/inscr.htm
depend	Dependency ratio is the share of population below 15 and beyond 64 to the population between 15 and 64 from World Development Indicators	World Development Indicators 2005, World Bank
urban	The share of total population living in urban areas from World Development Indicators	World Development Indicators 2005, World Bank
war	ACTOTAL from Major Episodes of Political Violence (MEPV) and conflict regions, range from 0 (no violence) to 10	http://www.systemicpeace.org/warlist.htm
lagopenness	log-share of export plus import to real GDP (in %) from Penn World Tables 6.2	http://pwt.econ.upenn.edu/

Table 3.2: Sample descriptive statistics

		OECD		non-OECD	
		1964-1983	1984-2000	1964-1983	1984-2000
g	mean (std)	2.80 (0.27)	2.89 (0.29)	2.96 (0.49)	3.08 (0.46)
	[min,max]	[1.95,3.44]	[2.04,3.57]	[1.60,4.23]	[1.38,4.35]
importdiv	mean (std)	0.51 (0.05)	0.66 (0.06)	0.41 (0.09)	0.36 (0.16)
	[min,max]	[0.36,0.74]	[0.41,0.72]	[0.06,0.71]	[0.03,0.68]
diff_r	mean (std)	0.51 (0.02)	0.57 (0.02)	0.56 (0.04)	0.63 (0.05)
	[min,max]	[0.45,0.57]	[0.55,0.67]	[0.49,0.79]	[0.51,0.84]
diff_l	mean (std)	0.81 (0.02)	0.85 (0.02)	0.85 (0.03)	0.89 (0.02)
	[min,max]	[0.79,0.86]	[0.84,0.93]	[0.78,0.99]	[0.82,0.97]
loggdp	mean (std)	18.93 (1.43)	19.42 (1.43)	16.30 (1.70)	16.69 (1.78)
	[min,max]	[14.56,22.36]	[15.42,22.92]	[11.26,20.72]	[11.28, 21.57]
logpop	mean (std)	9.60 (1.42)	9.74 (1.41)	8.40 (1.83)	8.65 (1.81)
	[min,max]	[5.26,12.37]	[5.49,12.54]	[3.78,13.82]	[3.67,13.79]
polity2	mean (std)	6.35 (6.47)	8.48 (3.72)	-3.49 (6.29)	-0.52 (6.52)
	[min,max]	[-9,10]	[-7,10]	[-10,10]	[-10,10]
depend	mean (std)	0.60 (0.11)	0.51 (0.06)	0.86 (0.14)	0.77 (0.18)
	[min,max]	[0.46,1.03]	[0.40,0.84]	[0.42,1.15]	[0.38,1.17]
urban	mean (std)	67.69 (16.58)	73.40 (12.56)	37.33 (23.54)	46.19 (23.67)
	[min,max]	[24.13,95.61]	[38.20,97.19]	[2.31,100]	[5.04,100]
war	mean (std)	0.22 (0.68)	0.18 (0.67)	0.93 (1.93)	1.23 (2.30)
	[min,max]	[0.00,3.75]	[0.00,4.00]	[0.00,14.00	[0.00,14.00]
lagopenness	mean (std)	3.33 (0.63)	3.76 (0.54)	3.95 (0.76)	4.09 (0.72)
	[min,max]	[1.73,4.66]	[2.52,4.93]	[1.95,6.41]	[1.42,6.44]

Table 3.3: Correlations of main variables in OECD (1964-1983)

	importdiv	diff_r	diff_l	loggdp	importdiv×diff_r
diff_r	-0.19				
diff_l	-0.24	0.94			
loggdp	0.47	-0.32	-0.45		
importdiv×diff_r	0.94	0.15	0.08	0.37	
importdiv×loggdp	0.91	-0.24	-0.34	0.79	0.84

Table 3.4: Country fixed effects regression with all countries (1964-2000), I

Dependent variable: Log of government consumption (in % of GDP)						
	(1)	(2)	(3)	(4)	(5)	(6)
importdiv	0.163	1.934***	1.941***	4.366***	2.145***	6.040***
	(0.115)	(0.642)	(0.638)	(1.208)	(0.641)	(2.251)
importdiv×loggdp		-0.106***	-0.111***	-0.139***	-0.117***	-0.135***
		(0.038)	(0.038)	(0.039)	(0.037)	(0.039)
diff$_r$			-0.775**	0.047		
			(0.322)	(0.443)		
importdiv×diff$_r$				-3.121**		
				(1.339)		
diff$_l$					-0.797*	0.444
					(0.464)	(0.813)
importdiv×diff$_l$						-4.019*
						(2.219)
loggdp	-0.201***	-0.162***	-0.156***	-0.153***	-0.160***	-0.163***
	(0.042)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
logpop	0.262***	0.248***	0.254***	0.250***	0.253***	0.253***
	(0.072)	(0.073)	(0.073)	(0.074)	(0.073)	(0.073)
oecd×after84	0.032	0.063*	0.074**	0.073**	0.066*	0.062*
	(0.033)	(0.034)	(0.035)	(0.035)	(0.034)	(0.035)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	1150	1150	1150	1150	1150	1150
# Countries	156	156	156	156	156	156
R^2	0.141	0.148	0.154	0.159	0.151	0.154

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3.5: Country fixed effects regression with all countries (1964-2000), II

Dependent variable: Log of government consumption (in % of GDP)						
	(1)	(2)	(3)	(4)	(5)	(6)
importdiv	0.155	2.727***	2.566***	5.940***	2.743***	9.129***
	(0.132)	(0.848)	(0.862)	(1.582)	(0.840)	(2.887)
importdiv×loggdp		-0.151***	-0.145***	-0.191***	-0.152***	-0.190***
		(0.049)	(0.049)	(0.053)	(0.048)	(0.052)
diff$_r$			-0.651*	0.441		
			(0.361)	(0.478)		
importdiv×diff$_r$				-4.078***		
				(1.546)		
diff$_l$					-0.084	1.974**
					(0.521)	(0.961)
importdiv×diff$_l$						-6.372**
						(2.642)
loggdp	-0.229***	-0.172***	-0.165***	-0.162***	-0.172***	-0.180***
	(0.053)	(0.054)	(0.055)	(0.054)	(0.054)	(0.053)
logpop	0.328***	0.307***	0.305***	0.296***	0.307***	0.302***
	(0.097)	(0.098)	(0.098)	(0.099)	(0.098)	(0.100)
oecd×after84	0.005	0.047	0.049	0.047	0.047	0.038
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)
depend	-0.169	-0.178	-0.129	-0.152	-0.175	-0.211*
	(0.126)	(0.125)	(0.128)	(0.127)	(0.126)	(0.126)
polity2	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
urban	-0.003	-0.003	-0.003	-0.002	-0.003	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
war	0.016***	0.016***	0.016***	0.015***	0.016***	0.015***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
lagopenness	0.095***	0.099***	0.095***	0.080***	0.099***	0.086***
	(0.028)	(0.028)	(0.028)	(0.029)	(0.029)	(0.030)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	987	987	987	987	987	987
# Countries	140	140	140	140	140	140
R^2	0.176	0.186	0.191	0.198	0.186	0.193

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.6: Country fixed effects regression with OECD countries (1964-2000), I

Dependent variable: Log of government consumption (in % of GDP)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
importdiv	0.009	4.236***	4.475***	-1.929	-0.590		-10.640**	
	(0.240)	(1.504)	(1.494)	(1.978)	(1.932)		(4.888)	
importdiv×**loggdp**		-0.209***	-0.215***	-0.192**	-0.232***	-0.238***	-0.177***	-0.233***
		(0.077)	(0.077)	(0.074)	(0.073)	(0.063)	(0.067)	(0.065)
diff$_r$			-0.661	-6.135***	-5.897***	-5.484***		
			(0.575)	(1.664)	(1.718)	(1.392)		
importdiv×**diff**$_r$				10.913***	9.988***	9.143***		
				(3.071)	(3.022)	(2.306)		
diff$_l$							-10.685***	-4.617***
							(3.479)	(1.265)
importdiv×**diff**$_l$							17.269***	5.867***
							(5.762)	(1.560)
loggdp	-0.376***	-0.246***	-0.242***	-0.248***	-0.163*	-0.159**	-0.191**	-0.163**
	(0.055)	(0.079)	(0.079)	(0.078)	(0.084)	(0.080)	(0.081)	(0.080)
logpop	0.818***	0.807***	0.780***	0.763***	0.642***	0.641***	0.578***	0.610***
	(0.146)	(0.137)	(0.128)	(0.124)	(0.129)	(0.128)	(0.135)	(0.130)
polity2	0.012***	0.011***	0.011***	0.011***	0.013***	0.013***	0.013***	0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
depend	0.498***	0.541***	0.572***	0.551***	0.412**	0.415**	0.407**	0.419**
	(0.169)	(0.167)	(0.172)	(0.170)	(0.165)	(0.164)	(0.163)	(0.164)
lagopenness					-0.145***	-0.146***	-0.144***	-0.154***
					(0.045)	(0.044)	(0.046)	(0.045)
Time Dummies	yes	yes	yes	yes	yes	yes	yes	yes
# Obs.	234	234	234	234	229	229	229	229
# Countries	28	28	28	28	28	28	28	28
R^2	0.480	0.515	0.518	0.533	0.584	0.584	0.590	0.583

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.7: Country fixed effects regression with OECD countries (1964-2000), II

Dependent variable: Log of government consumption (in % of GDP)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
importdiv	4.573*		-4.698**		-3.240*		7.138		-10.630***	
	(2.336)		(1.831)		(1.800)		(4.458)		(3.613)	
importdiv×**loggdp**	-0.250***	-0.192***	0.013	-0.044	-0.015	-0.055	-0.263***	-0.221***	0.015	-0.042
	(0.079)	(0.068)	(0.066)	(0.053)	(0.068)	(0.054)	(0.080)	(0.075)	(0.064)	(0.060)
diff$_r$	0.681	-2.004*	-4.275***	-1.135	-3.662***	-1.512				
	(1.604)	(1.179)	(1.314)	(1.274)	(1.280)	(1.282)				
importdiv×**diff**$_r$	0.082	6.134***	8.449***	1.976	6.842***	2.397				
	(3.374)	(2.358)	(2.388)	(1.967)	(2.306)	(1.983)				
diff$_l$							1.547	-2.062*	-6.976***	-0.951
							(2.555)	(1.134)	(2.453)	(1.203)
importdiv×**diff**$_l$							-2.639	4.763***	12.577***	1.218
							(4.983)	(1.739)	(4.124)	(1.432)
loggdp	-0.257**	-0.280***	-0.566***	-0.534***	-0.503***	-0.477***	-0.254**	-0.265**	-0.517***	-0.490***
	(0.103)	(0.098)	(0.072)	(0.067)	(0.074)	(0.067)	(0.105)	(0.103)	(0.073)	(0.070)
logpop	0.693***	0.716***	0.670***	0.684***	0.516***	0.522***	0.674***	0.675***	0.487***	0.522***
	(0.142)	(0.142)	(0.120)	(0.120)	(0.114)	(0.112)	(0.144)	(0.143)	(0.115)	(0.112)
depend			0.548***	0.580***	0.379***	0.397***			0.378***	0.393***
			(0.158)	(0.158)	(0.142)	(0.141)			(0.142)	(0.144)
polity2			0.009***	0.008***	0.010***	0.009***			0.010***	0.009***
			(0.002)	(0.002)	(0.002)	(0.002)			(0.002)	(0.002)
urban			0.011***	0.011***	0.012***	0.012***			0.012***	0.013***
			(0.002)	(0.002)	(0.001)	(0.001)			(0.001)	(0.001)
war			0.052***	0.048***	0.052***	0.049***			0.051**	0.049**
			(0.020)	(0.018)	(0.020)	(0.018)			(0.020)	(0.020)
lagopenness					-0.169***	-0.175***			-0.165***	-0.175***
					(0.038)	(0.037)			(0.038)	(0.037)
Time Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
# Obs.	243	243	234	234	229	229	243	243	229	229
# Countries	29	29	28	28	28	28	29	29	28	28
R^2	0.389	0.382	0.638	0.632	0.705	0.702	0.384	0.380	0.707	0.700

Notes: Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.8: Country fixed effects interacted with period, OECD countries (1964-2000), I)

Dependent variable: Log of government consumption (in % of GDP)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
importdiv	-0.106	12.824***	11.818***	5.356		10.475**	-9.226	
	(0.537)	(3.705)	(3.680)	(3.902)		(3.975)	(5.629)	
importdiv×loggdp		-0.638***	-0.575***	-0.650***	-0.530***	-0.507**	-0.475***	-0.566***
		(0.175)	(0.176)	(0.150)	(0.097)	(0.192)	(0.154)	(0.139)
diff$_r$			-1.383	-7.864***	-10.470***			
			(0.904)	(1.782)	(1.887)			
importdiv×diff$_r$				14.444***	19.741***			
				(4.221)	(3.608)			
diff$_l$						-2.146*	-13.627***	-8.863***
						(1.181)	(2.338)	(1.460)
importdiv×diff$_l$							22.724***	13.881***
							(5.162)	(3.446)
loggdp	-0.245*	0.027	-0.012	0.039	-0.005	-0.064	-0.055	-0.021
	(0.121)	(0.145)	(0.158)	(0.136)	(0.117)	(0.176)	(0.148)	(0.152)
Time Dummies	yes	yes	yes	yes	yes	yes	yes	yes
# Obs.	243	243	243	243	243	243	243	243
# groups	55	55	55	55	55	55	55	55
R^2	0.281	0.409	0.422	0.460	0.448	0.425	0.473	0.464

Notes: Robust standard errors clustered by countries in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.9: Country fixed effects interacted with period, OECD countries (1964-2000), II

Dependent variable: Log of government consumption (in % of GDP)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
importdiv	-0.221	8.826***	8.000***	4.740**			6.882**	-6.149**		
	(0.234)	(2.674)	(2.146)	(2.013)			(2.558)	(2.964)		
importdiv×**loggdp**		-0.452***	-0.391***	-0.508***	-0.361***	-0.269***	-0.340**	-0.373***	-0.440***	-0.318**
		(0.127)	(0.104)	(0.077)	(0.044)	(0.086)	(0.125)	(0.072)	(0.076)	(0.140)
diff$_r$			-1.570***	-6.378***	-8.067***	-6.662***				
			(0.503)	(0.805)	(0.926)	(1.917)				
importdiv×**diff**$_r$				10.336***	13.646***	10.449***				
				(2.081)	(1.562)	(3.279)				
diff$_l$							-1.736*	-10.309***	-7.059***	-6.514***
							(0.929)	(1.385)	(1.028)	(1.392)
importdiv×**diff**$_l$								16.491***	10.654***	7.972**
								(3.083)	(1.775)	(3.338)
loggdp	-0.384***	-0.138	-0.153*	-0.055	-0.122	-0.246**	-0.199*	-0.138	-0.118	-0.248*
	(0.085)	(0.103)	(0.088)	(0.086)	(0.089)	(0.096)	(0.115)	(0.094)	(0.102)	(0.127)
logpop	0.455**	0.433**	0.359*	0.230	0.196	0.522**	0.384*	0.232	0.287	0.565**
	(0.211)	(0.210)	(0.186)	(0.184)	(0.185)	(0.208)	(0.193)	(0.185)	(0.178)	(0.208)
depend	0.131	0.165	0.280	0.250	0.231	0.616*	0.250	0.265	0.257	0.651*
	(0.290)	(0.252)	(0.248)	(0.234)	(0.241)	(0.310)	(0.274)	(0.257)	(0.258)	(0.327)
polity2	0.008***	0.008***	0.008***	0.008***	0.008***	0.007**	0.008***	0.008***	0.008***	0.007**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
urban	0.012***	0.010***	0.010***	0.009***	0.009***	0.007**	0.010***	0.009***	0.009***	0.007**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
war	0.032*	0.004	0.006	0.005	0.015	0.018	0.005	0.005	0.001	0.004
	(0.018)	(0.012)	(0.011)	(0.012)	(0.012)	(0.015)	(0.012)	(0.013)	(0.012)	(0.014)
lagopenness	-0.200***	-0.210***	-0.220***	-0.226***	-0.225***		-0.211***	-0.214***	-0.214***	
	(0.051)	(0.055)	(0.043)	(0.036)	(0.034)		(0.047)	(0.037)	(0.041)	
Time Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
# Obs.	229	229	229	229	229	234	229	229	229	234
# groups	53	53	53	53	53	53	53	53	53	53
R^2	0.653	0.689	0.703	0.719	0.712	0.597	0.698	0.719	0.716	0.608

Notes: Robust standard errors clustered by countries in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.10: Country fixed effects with OECD countries (1964-1983), I

Dependent variable: Log of government consumption (in % of GDP)						
	(1)	(2)	(3)	(4)	(5)	(6)
importdiv	-0.337	13.827***	12.733***	6.521**	10.492**	-9.202*
	(0.402)	(3.174)	(2.981)	(2.524)	(4.163)	(5.025)
importdiv×**loggdp**		-0.688***	-0.619***	-0.866***	-0.507**	-0.634***
		(0.144)	(0.140)	(0.129)	(0.203)	(0.166)
diff$_r$			-1.539	-10.247***		
			(0.963)	(1.891)		
importdiv×**diff**$_r$				20.364***		
				(4.790)		
diff$_l$					-2.382	-15.016***
					(1.563)	(3.153)
importdiv×**diff**$_l$						26.536***
						(6.774)
loggdp	-0.157	0.005	-0.025	0.059	-0.073	-0.035
	(0.130)	(0.133)	(0.138)	(0.115)	(0.143)	(0.123)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	132	132	132	132	132	132
# Countries	27	27	27	27	27	27
R^2	0.279	0.426	0.444	0.514	0.445	0.515

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.11: Country fixed effects with OECD countries (1964-1983), II

Dependent variable: Log of government consumption (in % of GDP)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
importdiv	6.895***	7.546***	5.493**	11.570***	-3.442	-4.516	-4.968	-3.226
	(2.366)	(2.709)	(2.585)	(3.795)	(5.140)	(4.328)	(3.818)	(8.186)
importdiv×loggdp	-0.757***	-0.647***	-0.532***	-0.923***	-0.598***	-0.426***	-0.328**	-0.659***
	(0.120)	(0.135)	(0.134)	(0.165)	(0.154)	(0.159)	(0.145)	(0.216)
diff$_r$	-7.155***	-6.503***	-6.408***	-7.461***				
	(1.778)	(1.580)	(1.157)	(2.587)				
importdiv×diff$_r$	14.931***	10.578***	9.863***	13.308***				
	(4.280)	(3.403)	(2.673)	(4.055)				
diff$_l$					-10.103***	-10.798***	-9.785***	-12.475***
					(3.282)	(2.556)	(2.123)	(4.402)
importdiv*diff$_l$					18.360***	16.099***	14.069***	20.090***
					(6.508)	(4.686)	(4.106)	(6.654)
loggdp	-0.094	-0.196	-0.041	0.236	-0.151	-0.296**	-0.152	0.114
	(0.138)	(0.125)	(0.120)	(0.151)	(0.139)	(0.130)	(0.123)	(0.178)
logpop	0.595**	0.729***	0.257	0.227	0.564**	0.677***	0.262	0.220
	(0.250)	(0.229)	(0.193)	(0.238)	(0.268)	(0.228)	(0.195)	(0.236)
depend		0.568**	0.285	0.078		0.589**	0.298	0.109
		(0.225)	(0.204)	(0.229)		(0.230)	(0.216)	(0.238)
polity2		0.011***	0.008***	0.009***		0.011***	0.008***	0.008***
		(0.003)	(0.002)	(0.002)		(0.003)	(0.002)	(0.002)
urban		0.005	0.010***	0.010***		0.005	0.011***	0.010***
		(0.004)	(0.002)	(0.003)		(0.004)	(0.002)	(0.003)
war		-0.003	-0.002	-0.037**		0.000	0.000	-0.031**
		(0.020)	(0.020)	(0.015)		(0.021)	(0.022)	(0.015)
lagopenness			-0.263***				-0.251***	
			(0.041)				(0.041)	
exportdiv				-0.377				-0.463*
				(0.231)				(0.236)
imports				-0.188**				-0.187**
				(0.080)				(0.077)
Time Dummies	yes	yes	yes	yes	yes	yes	yes	yes
# Obs.	132	127	124	113	132	127	124	113
# Countries	27	26	26	23	27	26	26	23
R^2	0.552	0.730	0.823	0.780	0.548	0.736	0.822	0.786

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.12: Country fixed effects with OECD countries (1964-1983), III

Dependent variable: Log of government consumption (in % of GDP)			
	(1)	(2)	(3)
importdiv×**diff**$_r$	1.007*	0.673	12.820***
	(0.604)	(0.467)	(2.657)
diff$_r$	-3.091***	-3.018***	-7.996***
	(0.914)	(0.694)	(1.276)
importdiv×**loggdp**			-0.337***
			(0.074)
loggdp	-0.479***	-0.263**	-0.097
	(0.115)	(0.124)	(0.121)
logpop	0.734***	0.252	0.159
	(0.236)	(0.189)	(0.178)
depend	0.562**	0.281	0.201
	(0.234)	(0.209)	(0.204)
polity2	0.011***	0.008***	0.008***
	(0.003)	(0.002)	(0.002)
urban	0.007	0.013***	0.011***
	(0.004)	(0.002)	(0.002)
war	0.038**	0.030**	0.013
	(0.019)	(0.015)	(0.015)
lagopenness		-0.281***	-0.277***
		(0.042)	(0.040)
Time Dummies	yes	yes	yes
# Obs.	127	124	124
# Countries	26	26	26
R^2	0.678	0.786	0.811

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.13: Country fixed effects with OECD countries (1984-2000)

Dependent variable: Log of government consumption (in % of GDP)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
importdiv	1.047**		0.944*		-13.705	-13.626	21.114
	(0.418)		(0.549)		(19.436)	(19.754)	(35.156)
importdiv×**loggdp**					0.766	0.763	0.403
					(1.013)	(1.030)	(1.005)
diff$_r$						0.857	32.192
						(1.331)	(29.632)
importdiv×**diff**$_r$		1.832***		1.632**			-48.953
		(0.667)		(0.776)			(46.701)
loggdp	-0.387***	-0.377***	-0.451***	-0.435***	-0.972	-0.957	-0.717
	(0.101)	(0.099)	(0.077)	(0.077)	(0.715)	(0.726)	(0.709)
logpop			-0.131	-0.138	-0.260	-0.273	-0.206
			(0.323)	(0.317)	(0.367)	(0.372)	(0.351)
depend			0.114	0.135	0.153	0.180	0.273
			(0.439)	(0.444)	(0.441)	(0.452)	(0.449)
polity2			0.002	0.002	0.001	0.001	0.002
			(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
urban			0.009***	0.009***	0.010***	0.010***	0.009***
			(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
war			0.012	0.013	0.008	0.009	0.010
			(0.023)	(0.022)	(0.025)	(0.024)	(0.026)
lagopenness			-0.087	-0.083	-0.064	-0.062	-0.056
			(0.074)	(0.072)	(0.083)	(0.083)	(0.081)
Time Dummies	yes	yes	yes	yes	yes	yes	yes
# Obs.	111	111	105	105	105	105	105
# Countries	28	28	27	27	27	27	27
R^2	0.396	0.398	0.566	0.567	0.573	0.575	0.584

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.14: Country fixed effects with non-OECD countries (1964-2000)

Dependent variable: Log of government consumption (in % of GDP)						
	(1)	(2)	(3)	(4)	(5)	(6)
importdiv	1.404*	1.509**	4.298***	6.070***	5.779***	2.552**
	(0.750)	(0.753)	(1.342)	(1.853)	(1.971)	(1.108)
importdiv×loggdp	-0.073	-0.086*	-0.116**	-0.189***	-0.198***	-0.150**
	(0.045)	(0.046)	(0.047)	(0.065)	(0.071)	(0.065)
diff$_r$		-0.869**	0.048	0.414	0.309	-0.659
		(0.360)	(0.469)	(0.532)	(0.531)	(0.417)
importdiv×diff$_r$			-3.641**	-4.528**	-3.793**	
			(1.484)	(1.756)	(1.800)	
loggdp	-0.167***	-0.155***	-0.155***	-0.168***	-0.141**	-0.146**
	(0.049)	(0.050)	(0.049)	(0.059)	(0.062)	(0.063)
logpop	0.237***	0.243***	0.241***	0.255**	0.297**	0.295**
	(0.083)	(0.084)	(0.086)	(0.126)	(0.128)	(0.127)
polity2				-0.005**	-0.005**	-0.005**
				(0.002)	(0.002)	(0.002)
depend				-0.263*	-0.226	-0.187
				(0.141)	(0.144)	(0.145)
lagopenness				0.102***	0.107***	0.121***
				(0.031)	(0.031)	(0.030)
aidpc					0.000	0.000
					(0.000)	(0.000)
war					0.014***	0.014**
					(0.005)	(0.005)
urban					-0.004*	-0.005**
					(0.002)	(0.002)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	907	907	907	758	733	733
# Countries	127	127	127	112	109	109
R^2	0.141	0.149	0.156	0.199	0.212	0.205

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.15: Country fixed effects interacted with period, non-OECD countries (1964-2000)

Dependent variable: Log of government consumption (in % of GDP)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
importdiv	0.403**	1.578	1.480	0.269	1.593	0.181		
	(0.189)	(1.410)	(1.413)	(2.253)	(1.408)	(4.266)		
importdiv×**loggdp**		-0.069	-0.064	-0.048	-0.070	-0.061		
		(0.079)	(0.079)	(0.082)	(0.079)	(0.087)		
diff$_r$			-0.312	-0.679				
			(0.421)	(0.589)				
importdiv×**diff**$_r$				1.514			0.635**	
				(2.187)			(0.317)	
diff$_l$					-0.149	-0.570		
					(0.790)	(1.318)		
importdiv×**diff**$_l$						1.429		0.451**
						(3.762)		(0.213)
loggdp	-0.197***	-0.173***	-0.169**	-0.170**	-0.172**	-0.170**	-0.196***	-0.196***
	(0.062)	(0.065)	(0.067)	(0.066)	(0.066)	(0.066)	(0.063)	(0.062)
logpop	0.359*	0.346*	0.339*	0.337*	0.346*	0.344*	0.361*	0.357*
	(0.195)	(0.195)	(0.195)	(0.195)	(0.196)	(0.196)	(0.194)	(0.194)
depend	-0.048	-0.080	-0.068	-0.071	-0.075	-0.074	-0.058	-0.054
	(0.197)	(0.196)	(0.201)	(0.201)	(0.200)	(0.200)	(0.195)	(0.196)
polity2	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
urban	-0.007	-0.007	-0.006	-0.006	-0.007	-0.006	-0.007	-0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
war	0.019***	0.020***	0.020***	0.020***	0.020***	0.020***	0.019***	0.019***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
lagopenness	0.070*	0.070*	0.068	0.070*	0.069	0.070	0.073*	0.071*
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.043)	(0.041)	(0.041)
Time Dummies	yes	yes	yes	yes	yes	yes	yes	yes
# Obs.	758	758	758	758	758	758	758	758
# groups	195	195	195	195	195	195	195	195
R^2	0.246	0.247	0.248	0.248	0.247	0.247	0.245	0.246

Notes: Robust standard errors clustered by countries in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.16: No log variables, OECD countries (1964-1983)

Dependent variable: Government consumption (in % of GDP)						
	(1)	(2)	(3)	(4)	(5)	(6)
importdiv	-2.597	224.079***	199.011***	171.545***	138.859***	-10.885
	(4.765)	(52.605)	(42.978)	(47.316)	(50.520)	(71.015)
importdiv×gdp		-11.307***	-9.589***	-11.945***	-6.524**	-7.906***
		(2.599)	(2.171)	(2.483)	(2.633)	(2.829)
diff$_r$			-32.698***	-91.973***		
			(10.073)	(26.365)		
importdiv×diff$_r$				136.335**		
				(63.470)		
diff$_l$					-55.650***	-161.316***
					(17.955)	(39.257)
importdiv×diff$_l$						213.220***
						(78.660)
gdp	-9.193***	-4.214*	-4.587**	-3.189	-6.172**	-5.139**
	(2.196)	(2.278)	(2.190)	(2.391)	(2.371)	(2.495)
pop	13.025***	12.880***	11.119***	9.200**	11.153***	8.564**
	(4.527)	(4.095)	(4.114)	(4.309)	(4.066)	(4.278)
depend	7.984	10.082**	13.319**	12.134**	13.516**	12.831**
	(5.074)	(4.598)	(5.131)	(5.162)	(5.371)	(5.307)
polity2	0.176***	0.157***	0.159***	0.158***	0.157***	0.159***
	(0.053)	(0.051)	(0.052)	(0.050)	(0.054)	(0.052)
urban	0.149**	0.104	0.112	0.102	0.119	0.115
	(0.073)	(0.075)	(0.077)	(0.075)	(0.073)	(0.071)
war	0.460	-0.369	-0.258	-0.330	-0.223	-0.264
	(0.337)	(0.359)	(0.336)	(0.351)	(0.359)	(0.379)
lagopenness	0.023	-0.001	0.008	0.003	0.011	0.008
	(0.039)	(0.037)	(0.038)	(0.038)	(0.037)	(0.037)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	124	124	124	124	124	124
# Countries	26	26	26	26	26	26
R^2	0.592	0.670	0.690	0.700	0.697	0.711

Notes: Country fixed effects estimation.
Robust standard errors in parentheses.
*significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.17: Arellano-Bond GMM estimation, OECD countries (1964-1983)

Dependent variable: Log of government consumption (in % of GDP)						
	(1)	(2)	(3)	(4)	(5)	(6)
laggovshare	0.465***	0.392***	0.411**	0.306**	0.420**	0.336**
	(0.116)	(0.124)	(0.171)	(0.148)	(0.164)	(0.151)
importdiv	-0.363*	6.637***	6.141***	4.669***	5.465**	-0.964
	(0.190)	(2.141)	(2.130)	(1.744)	(2.390)	(2.403)
importdiv×**loggdp**		-0.349***	-0.321***	-0.374***	-0.284**	-0.303***
		(0.102)	(0.103)	(0.085)	(0.122)	(0.103)
diff$_r$				-3.464***		
				(0.674)		
importdiv×**diff**$_r$				5.294***		
				(1.253)		
diff$_l$					-0.453	-4.972***
					(0.917)	(1.221)
importdiv×**diff**$_l$						8.348***
						(1.909)
loggdp	-0.267***	-0.181***	-0.256***	-0.199**	-0.260***	-0.243**
	(0.098)	(0.068)	(0.084)	(0.095)	(0.087)	(0.097)
logpop	0.663***	0.687***	0.567***	0.382**	0.535***	0.410**
	(0.169)	(0.174)	(0.167)	(0.180)	(0.173)	(0.187)
polity2	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
depend	0.133	0.158	0.171	0.228	0.187	0.206
	(0.170)	(0.160)	(0.191)	(0.185)	(0.191)	(0.196)
lagopenness			-0.015	-0.072	-0.016	-0.049
			(0.063)	(0.062)	(0.065)	(0.061)
war			0.000	0.004	0.001	0.006
			(0.014)	(0.016)	(0.015)	(0.016)
urban			0.008***	0.009***	0.008***	0.009***
			(0.002)	(0.002)	(0.002)	(0.002)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	98	98	98	98	98	98
# Countries	26	26	26	26	26	26
Sargan Test	[0.49]	[0.46]	[0.58]	[0.47]	[0.53]	[0.32]
AR(2) Test	[0.22]	[0.98]	[0.71]	[0.95]	[0.63]	[0.74]

Notes: Country fixed effects estimation.
Robust standard errors in parentheses.
Sargan Test of over-identifying restrictions is based on the homoskedastic estimator.
*significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.18: Various robustness, OECD countries (1964-1983)

Dependent variable: Log of government consumption (in % of GDP)	alternative measure for importdiv			alternative measure for diff	yearly data		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
importdiv[1)]	1.976***	1.684***	1.535***	-3.510	10.194***	9.500***	6.277***
	(0.439)	(0.438)	(0.419)	(3.505)	(1.339)	(1.172)	(1.311)
importdiv×**loggdp**[1)]	-0.103***	-0.088***	-0.082***	-0.375***	-0.525***	-0.535***	-0.474***
	(0.023)	(0.023)	(0.022)	(0.142)	(0.066)	(0.070)	(0.072)
diff$_r$[2)]		-1.538***		-53.529***		-1.660***	
		(0.470)		(10.887)		(0.396)	
importdiv×**diff**$_r$[2)]				77.595***		2.144**	
				(21.330)		(1.004)	
diff$_l$			-2.328***				-2.962***
			(0.686)				(0.666)
importdiv×**diff**$_l$							3.808***
							(1.462)
loggdp	0.523**	0.471**	0.411*	-0.124	-0.210***	-0.191***	-0.222***
	(0.227)	(0.214)	(0.207)	(0.122)	(0.057)	(0.059)	(0.060)
logpop	0.405**	0.369**	0.380**	0.261	0.818***	0.699***	0.689***
	(0.170)	(0.165)	(0.168)	(0.195)	(0.101)	(0.105)	(0.103)
polity2	0.009***	0.009***	0.009***	0.008***	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
depend	0.414	0.386*	0.358	0.308	0.322***	0.371***	0.379***
	(0.253)	(0.220)	(0.215)	(0.215)	(0.108)	(0.115)	(0.116)
lagopenness	-0.214***	-0.254***	-0.238***	-0.253***	-0.176***	-0.189***	-0.190***
	(0.050)	(0.038)	(0.037)	(0.041)	(0.027)	(0.026)	(0.026)
urban	0.007**	0.007***	0.007***	0.011***	0.009***	0.010***	0.010***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
war	0.039***	0.025**	0.019*	-0.001	-0.011	-0.009	-0.009
	(0.012)	(0.010)	(0.011)	(0.021)	(0.009)	(0.009)	(0.009)
Time Dummies	yes	yes	yes	yes	yes	yes	yes
# Obs.	124	124	124	124	498	498	498
# Countries	26	26	26	26	26	26	26
R^2	0.803	0.829	0.834	0.822	0.716	0.729	0.729

Notes: Country fixed effects estimation.
Robust standard errors in parentheses.
*significant at 10%; ** significant at 5%; *** significant at 1%.
1) In column (1) to (3) the alternative measure for *importdiv* is used.
2) In column (4) the alternative measure *lov* instead of *diff* is used.

3.7 Appendix B

Table 3.19: Elasticity of substitution, sample means for Rauch's classifications

	Broda and Weinstein's (2006) estimated elasticity of substitution	
Rauch's classification	1972-1988	1990-2001
differentiated goods	5.2	4.7
reference priced goods	7.8	4.9
goods on organized exchange	15.3	11.6

Source: Broda and Weinstein (2006, table VI)

Table 3.20: List of Countries

Afghanistan	Djibouti	Laos	Samoa
Albania	Dominican Republic	Latvia	Saudi Arabia
Algeria	Ecuador	Lebanon	Senegal
Angola	Egypt	Liberia	Seychelles
Argentina	El Salvador	Lithuania	Sierra Leone
Armenia	Equatorial Guinea	Macedonia	Singapore
Australia§	Estonia	Madagascar	Slovak Republic§
Austria§	Ethiopia	Malawi	Slovenia
Azerbaijan	Fiji	Malaysia	Somalia
Bahamas	Finland§	Mali	South Africa
Bahrain	France§	Malta	Spain§
Bangladesh	Gabon	Mauritania	Sri Lanka
Barbados	Gambia	Mauritius	St. Kitts and Nevis
Belarus	Georgia	Mexico§	Sudan
Belgium§	Germany§	Mongolia	Suriname
Belize	Ghana	Morocco	Sweden§
Benin	Greece§	Mozambique	Switzerland§
Bermuda	Guatemala	Nepal	Syria
Bolivia	Guinea	Netherlands§	Taiwan
Bosnia and Herzegovina	Guinea-Bissau	Netherlands Antilles	Tajikistan
Brazil	Guyana	New Zealand§	Tanzania
Burkina Faso	Haiti	Nicaragua	Thailand
Burundi	Honduras	Niger	Togo
Cambodia	Hungary§	Nigeria	Trinidad and Tobago
Cameroon	Iceland§	Norway§	Tunisia
Canada	India	Oman	Turkey§
Central African Republic	Indonesia	Pakistan	Turkmenistan
Chad	Iran	Panama	Uganda
Chile	Iraq	Papua New Guinea	Ukraine
China	Ireland§	Paraguay	United Arab Emirates
Colombia	Israel	Peru	United Kingdom§
Costa Rica	Italy§	Philippines	United States§
Cote d'Ivoire	Jamaica	Poland§	Uruguay
Croatia§	Japan§	Portugal§	Uzbekistan
Cuba	Jordan	Qatar	Venezuela
Cyprus	Kenya	Republic of Korea§	Vietnam
Czech Republic§	Kiribati	Romania	Yemen
Dem. Rep. Korea	Kuwait	Russia	Zambia
Denmark§	Kyrgyzstan	Rwanda	Zimbabwe

Notes: OECD countries marked by §.

4

The Effect of Globalization on Nominal versus Real Government Share

In a seminal paper Baumol (1967) argues that a productivity increase in one sector induces wages to rise in all sectors if labor is mobile across sectors. As a result, the relative costs and price increase in the sector with lower productivity experience. It implies that the expenditure share for the low-productivity sector rises if real output shares are constant (i.e., if demand is price inelastic). This has been commonly called Baumol's cost disease.[1] This phenomenon has been mainly studied in the growth and public finance literature for closed economies. An analogous mechanism in the trade framework is the so-called Balassa-Samuelson effect. In a small open economy with integrated capital markets, higher productivity in the tradable sector leads to higher prices in the less progressive, labor intensive, non-tradable sector (Balassa, 1964; Samuelson, 1964).[2] The public sector

[1]Empirical evidence for Baumol's cost disease is provided e.g. in Baumol et al. (1985) using U.S. data from 1947 until 1976. They show that although in real terms there was little shift in output shares between services and manufactures, the relative price of services has risen. Also, using U.S. data for the period 1948 until 2001, Nordhaus (2008) find that stagnant industries show a higher growth in relative prices and declining relative real outputs. Spann (1977) provides empirical evidence for Baumol's hypothesis in the public sector.

[2]There is ample empirical evidence for the Balassa-Samuelson effect (e.g. Hsieh, 1982; Asea and Mendoza, 1994; De Gregorio et al. (1994)). De Gregorio et al. (1994), for example, find for the period 1970-1985 and for OECD countries a higher inflation in non-tradable goods than tradables which they relate to a faster growth of total factor productivity in tradables and a demand shift to non-tradable goods. See Froot and Rogoff (1995) for a survey of the econometric literature.

is typically characterized as labor intensive, exhibits low productivity growth and produces mainly non-tradable goods. If the elasticity of substitution between the private and public good is smaller than one, Baumol's cost disease and the Balassa-Samuelson effect provide us with an explanation for the steady growth of the public sector.

These insights point to another important channel which can explain the relationship between international integration and the government share. The rise in public expenditures may be driven by price changes rather than real expansion. This chapter analyzes the impact of globalization - more precisely integration of capital markets and trade liberalization - on the relative costs of the public sector in a general equilibrium framework.[3] Following Baumol (1967), the real public sector share is held constant while the effect on the expenditure share is analyzed. This procedure allows us to isolate the purely economic effects of integration on public sector growth from changes through the political channel. It is shown that capital market and goods market integration may lead to rising public budget shares. In particular, the chapter identifies a channel which is related to the Balassa-Samuelson and Baumol effect, however driven by a decrease in trade costs. Using a Melitz (2003) framework which accounts for heterogeneous firms, trade liberalization affects average productivity in the private sector positively which in turn raises the costs of the public sector. Furthermore, it is shown that capital inflow raises the relative wage rate and the relative costs in the labor intensive public sector.

The intention of the chapter is to tie in with the "openness and government size" literature. The standard approach in the theoretical literature dealing with the effect of globalization on government size is to compare optimal public good provision in open and closed economies. This approach implies that the public sector reacts actively with its share to globalization by taking into account the additional costs or benefits provided by market integration (see the discussion in Section 1.2.1). In this chapter we are interested in the question of how globalization can explain the gap or ratio between the nominal and real government share or in other words the ratio between the price level of governments (which is equal to the costs in the public sector) versus the price level of private goods.[4] To focus on that we completely refrain from political decisions on public good provision.

[3] This chapter draws on Falkinger and Hanslin (2010).

[4] According to national accounts the public sector is valued by its costs which implies that the price level of governments is equal to the unit costs in the public sector. These two terms are used interchangeably.

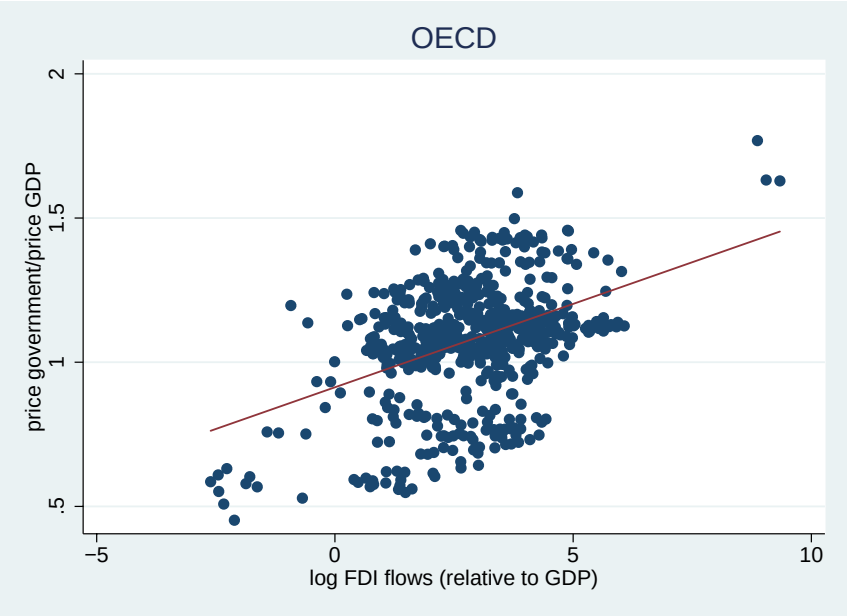
Although the relationship between openness and government size has been widely discussed in the literature, as far as I have found, the price level (or unit costs) of governments relative to the price level of GDP has not yet been related to measures of openness.[5] This is surprising, as data for OECD countries show an interesting correlation between the relative price level of governments to the price level of GDP and some measures of openness (figures 4.1-4.3). In figure 4.1 the correlation between the price level of government (relative to the price level of GDP) and FDI flows is plotted. One observation corresponds to a year between 1981 and 2004. The figure indicates that larger financial openness is associated with higher relative prices in governments. A similar picture is found for trade openness and relative prices. Higher exports and imports relative to GDP is positively correlated with relative price level (figure 4.2). Interestingly not only openness measures such as flows but also trade liberalization in the sense of a reduction of import tariffs is positively correlated with the relative price level as it is shown in figure 4.3.[6] Given these simple correlations in the data it seems worth to think about this relationship more intensely.

In order to analyze capital flows and relative prices of governments a Heckscher-Ohlin 2x2-production model with perfect competition suffices. The analysis shows that capital inflow depresses the interest rate and raises the relative wage rate which leads to higher relative public expenditure. Contrary, if opening capital markets leads to capital outflow, public spending decreases. It is well known from the literature, that higher relative capital (to labor) endowment leads to higher relative prices in service and/or non-market sectors (see for example, Bhagwati, 1984 and Gemmell, 1987). However, this literature focuses on closed factor markets. Relating relative prices to capital mobility has, to the best of my knowledge, not yet been covered, although capital flows have taken on a dimension which is far from negligible. Under open capital markets it is not relative endowment but relative employment of capital which is decisive for the relative factor prices which makes capital flows an important determinant for relative price levels of the non-tradable and

[5] It is quite common in the empirical analysis (e.g. Clague (1986) and Kravis and Lipsey (1982)) which try to explain national price levels (price of non-tradables versus price of tradables) to control for trade openness. Clague and Tanzi (1972) control also for tariffs.

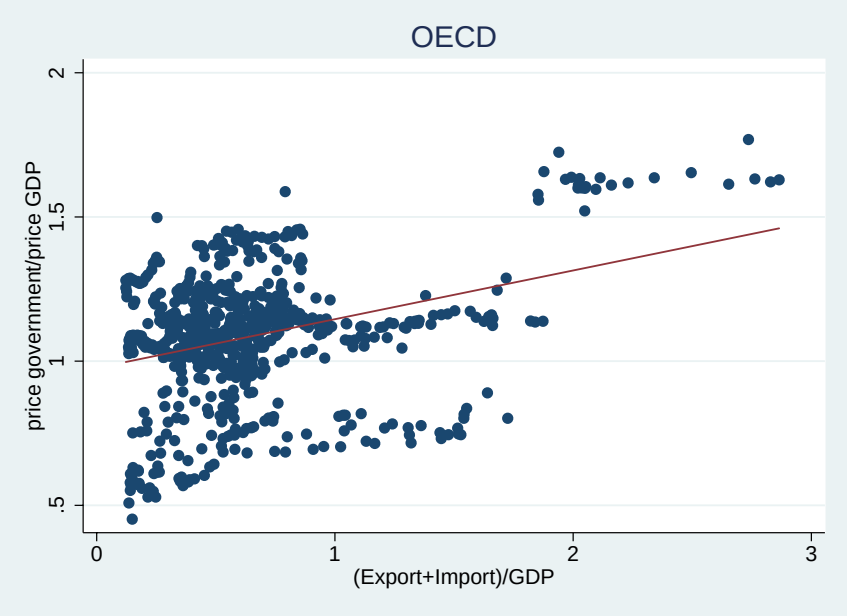
[6] One might argue that the negative correlation is simply because the price level of GDP is positively associated with tariffs. This is however not the case, the two measures are (interestingly) negatively correlated.

Figure 4.1: Scatter plot of relative price levels versus financial openness



Source: Penn World Tables (PWT) 6.2 and International Financial Statistics (own calculations)

Figure 4.2: Scatter plot of relative price levels versus openness in trade

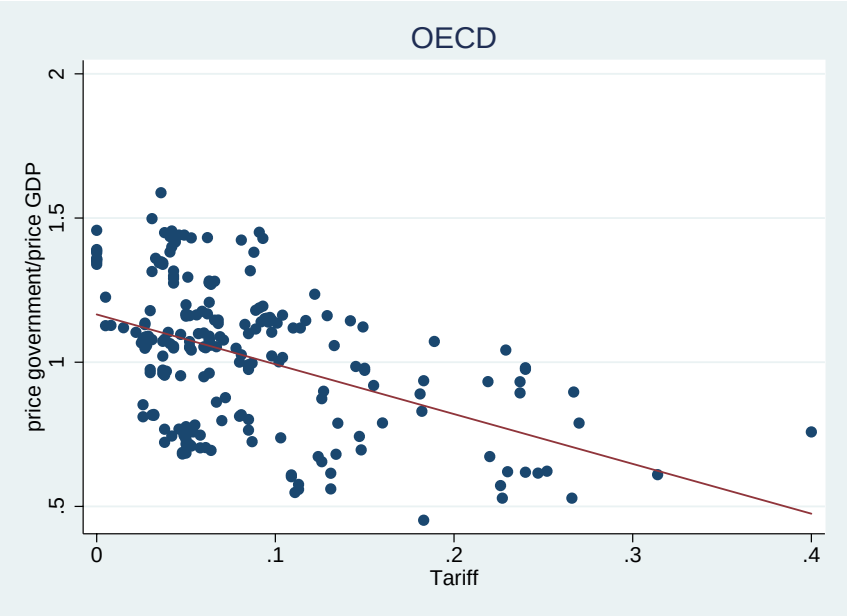


Source: PWT 6.2 (own calculations)

labor intensive public sector.

To address the question of a goods-trade induced Balassa-Samuelson and Baumol effect we require a framework where productivity depends on trade liberalization. A

Figure 4.3: Scatter plot of relative price levels versus average import tariffs



Source: PWT 6.2 and World Bank (own calculations)
Note: Due to data availability the sample covers only 15 OECD countries.

prominent example where average productivity depends on trade liberalization measures is the theoretical framework by Melitz (2003). Trade liberalization leads to higher average productivity of firms which lowers unit costs in the private sector and increases the relative costs of the public sector. Furthermore, the rise in average productivity increases the relative wage rate which induces an additional public cost push. This productivity change in the private sector, which is endogenously driven by trade liberalization, induces a rise in nominal public expenditures even if policy does not react to globalization by adjusting the real public sector share.

The two theoretical channels are analyzed empirically for a large country sample and separately for the OECD countries. Two measures for the relative costs of the public sector are used, both derived from PWT 6.2. One is the price level of governments relative to the price level of GDP. The other is the ratio between the government consumption share measured in current prices relative to the one measured in constant prices. It is investigated whether net capital inflow and trade liberalization have a positive effect on the two aforementioned measures.

Section 4.1 develops the theoretical framework and highlights the new results on public

sector expenditure shares in response to capital market and trade liberalization. Section 4.2 presents the empirical analysis of the two hypotheses derived from the theoretical model. Section 4.3 concludes.

4.1 Theoretical Analysis

We consider an economy with two sectors, a private and a public one, and two production factors, capital and labor. Both production factors can move freely between the sectors within a country. Labor is assumed to be immobile across countries. Generally also capital is immobile, apart from the section in which capital market integration will be discussed. The public sector produces one non-tradable public good. The private sector is assumed to be tradable.

Utility of the representative household depends on the private and public sector output. Preferences are given by a Leontief function

$$U = \min\{Q, \lambda G\} , \quad \lambda > 0 , \tag{4.1}$$

where G stands for public sector output and Q denotes consumption of private output. Optimal consumption implies that demand for the public good is proportional to demand for the private sector output

$$G = \frac{1}{\lambda} Q . \tag{4.2}$$

The assumption underlying the specification is that public and private goods are complements (the elasticity of substitution is zero). This assumption implies that price elasticity of demand is equal to zero. The assumption is of course extreme. There is however a strong consensus that demand for public goods is price inelastic. Early estimates of the price elasticity of demand for public goods were found to lie between -0.4 and -0.5 (see Bergstrom and Goodman, 1973 and Borcherding, 1985). Hence, assuming an elasticity of substitution between zero and one would be realistic but makes the analysis more complicated. Sticking to the assumption of complete inelastic demands avoids undue complexity. It is important to mention here that the obtained results on the gap between nominal and real government share do not require the strong assumption of no price elasticity.

The public good G is produced according to linear-homogeneous production function:

$$G = F^G(K_G, L_G) \ ,$$

with $\frac{\partial F^G}{\partial K}, \frac{\partial F^G}{\partial L} > 0$ and $\frac{\partial^2 F^G}{\partial K^2}, \frac{\partial^2 F^G}{\partial L^2} < 0$. K_G and L_G are the inputs of capital and labor.

It is assumed that the public sector takes factor prices as given. There is no direct price for the public good since it is not 'sold'. The implicit price of the public good is given by its unit costs, c_G. Total costs are financed by a lump-sum tax $T = c_G G$ which is levied on the representative consumer. Cost minimization of the public sector leads to minimal unit cost

$$c_G(r, w) = a_G(\omega)w + b_G(\omega)r$$

where $a_G(\omega)$ and $b_G(\omega)$ are the cost minimal labor and capital coefficients, respectively, and $\omega \equiv w/r$ is the factor price of labor relative to the factor price of capital.[7] Capital intensity in the public sector is given by $k_G \equiv \frac{K_G}{L_G} = \frac{b_G(\omega)}{a_G(\omega)}$.[8]

The two central measures for the size of the public sector are (i) the real government share which is provision of public good relative to the output of the private sector (X):

$$g \equiv \frac{G}{X}$$

and (ii) the nominal government share which is the costs of public good provision relative to the value of the domestic private sector output:

$$g_n \equiv \frac{c_G G}{pX} = \frac{c_G}{p} g \ .$$

In view of (4.2) the real government share is determined by the preference parameter such that $g = \frac{1}{\lambda}$ if $Q = X$. To discriminate between the nominal and real ratio of the public and the private sector provides the possibility to analyze the effects of globalization on the relative costs of the public sector. Thus the main focus will be on the ratio between the nominal and real government share $\frac{g_n}{g}$ for which we take the approach to keep real relative government activity unchanged (g) while analyzing the effects of globalization on

[7] For ω the term relative factor price of labor is often used.

[8] See Appendix 4.4.2 for the derivation of the cost-minimal input coefficients.

g_n. The qualitative effect on $\frac{g_n}{g}$ does not depend on the extreme assumption that public and private goods are perfect complements.[9]

This section considers first the effect of capital market integration and turns then to trade liberalization. The simplest framework to discuss capital market integration is the 2x2 production model with perfect competition in the private sector. In this framework, Section 4.1.1 shows how opening capital markets, leading to either capital in- or outflows, affects the relative price of governments.[10] Section 4.1.2 proceeds with the heterogeneous firms model à la Melitz (2003) with trade between symmetric countries in order to focus on the effect of trade liberalization on the relative prices. It is shown that trade liberalization can be responsible for a Balassa-Samuelson effect and a Baumol's cost disease in the public sector by rising average productivity in the private sector.

4.1.1 The Effect of Capital Market Integration on Nominal versus Real Government Share

The private sector produces the homogeneous good X under perfect competition according to a linear-homogeneous production function

$$X = AF^X(K_X, L_X)$$

with $\frac{\partial F^X}{\partial K}, \frac{\partial F^X}{\partial L} > 0$ and $\frac{\partial^2 F^X}{\partial K^2}, \frac{\partial^2 F^X}{\partial L^2} < 0$. The variable A is productivity, K_X and L_X represent capital and labor input for private production. Since the homogeneous good is freely tradable, its price is determined at the world market whose variables will be asterisked in the following. The world market price p^* is chosen as the numéraire.

Cost minimization leads to the minimal unit costs:

$$c_X(r, w, A) = a_X(\omega, A)w + b_X(\omega, A)r \tag{4.3}$$

where $a_X(\omega, A)$ and $b_X(\omega, A)$ with $\frac{\partial a_X}{\partial A} < 0$ and $\frac{\partial b_X}{\partial A} < 0$ are the cost minimal labor

[9] The effect of trade liberalization on $\frac{g_n}{g}$ is simulated for different values of the elasticity of substitution between zero and one in Appendix 4.4.4.

[10] Parts of the discussion in this Chapter draws on Falkinger (2008).

and capital coefficients, respectively.[11] Moreover, c_X is homogeneous of degree 1 and by Shephard's lemma, $\frac{\partial c_X}{\partial w} = a_X$ and $\frac{\partial c_X}{\partial r} = b_X$. An assumption which is essential for some of the obtained results is that the public sector produces more labor intensive than the private sector, that is $k_X > k_G$.[12]

The zero profit condition in the private sector reads

$$c_X(r, w, A) = 1(= p^*) \; . \tag{4.4}$$

Differentiating equation (4.4) implicitly we see that an increase in productivity A for a given interest rate raises the wage rate w.

Factor input in the two sectors is determined by the input coefficients times respective output. Hence, the resource constraints read:

$$a_X(\omega, A)X + a_G(\omega)G = \bar{L} \; , \tag{4.5}$$

$$b_X(\omega, A)X + b_G(\omega)G = \bar{K} \; , \tag{4.6}$$

where $\bar{L}$ is labor endowment available for production of the public and private goods. If capital markets are closed, there is $\bar{K}$ capital endowment available. If capital markets are integrated, the world market interest rate is given and available capital is determined endogenously. Solving (4.5) and (4.6) for G and X and using $b_G(\omega)/a_G(\omega) = k_G(\omega)$ and $b_X(\omega)/a_X(\omega) = k_X(\omega)$ we obtain the Rybczynski lines[13]

$$X = \frac{1}{a_X(\omega, A)} \frac{\bar{K} - k_G(\omega)\bar{L}}{k_X(\omega) - k_G(\omega)} \; , \tag{4.7}$$

$$G = \frac{1}{a_G(\omega)} \frac{k_X(\omega)\bar{L} - \bar{K}}{k_X(\omega) - k_G(\omega)} \; . \tag{4.8}$$

Note that $k_G(\omega) < \frac{\bar{K}}{\bar{L}} < k_X(\omega)$. Combining the two equations yields real government size

[11] See Appendix 4.4.2 for the derivation.

[12] With one factor of production (standard Melitz (2003) framework) the positive effect of trade liberalization on relative costs in the public sector remains valid.

[13] See Appendix 4.4.2 for the derivation of the Rybczynski lines. The Rybczynski theorem indicates that if prices are kept constant and the endowment of some factor rises while the endowment of the other factor is fixed, not all output can expand. The output of the sector which uses the factor with fixed endowment relatively intensively falls, output of the other sector increases (Rybczynski, 1955).

relative to the private sector

$$g \equiv \frac{G}{X} = \frac{a_X(\omega, A)}{a_G(\omega)} \frac{k_X(\omega) - k}{k - k_G(\omega)} \equiv \Gamma(\omega, A, k) \ , \tag{4.9}$$

where $k = \frac{\bar{K}}{\bar{L}}$ denotes the relative capital richness of the economy (measured by capital employment rather than endowment if the capital markets are open).

Lemma 4.1. *The function $\Gamma(\omega, A, k)$ depends positively on ω and negatively on k and A (ceteris paribus).*

Proof. See Appendix 4.4.1. □

For an exogenous real government share and exogenous relative capital endowment (closed capital markets), the relative wage rate is endogenously determined as a function of government size, capital-richness and productivity. By inverting (4.9), we obtain

$$\omega = \omega(g, A, k) \tag{4.10}$$

Proposition 4.1. *The relative wage rate, ω, depends positively on g, k and A.*

Proof. $\frac{\partial \omega}{\partial g} > 0$ follows directly from Lemma 4.1 since, for given k and A, $\omega(g, k, A)$ is the inverse of Γ. Further, because of Lemma 4.1, for given g, implicit differentiation of (4.9) gives us $\frac{\partial \omega}{\partial A} > 0$ and $\frac{\partial \omega}{\partial k} > 0$. □

The intuition is straightforward: a larger government (higher g) implies a higher relative demand for labor which raises the relative wage rate. Higher relative capital endowment k implies that the factor labor is getting relatively scarce in the economy so that its price rises. An increase of productivity A raises output of the private sector for given capital and labor demand. However, if we keep relative real government size constant, production of G must increase which raises relative demand for labor and hence, the relative wage rate.

The analysis so far provides very interesting insights for the relative cost of labor, a particularly important cost component of the public sector. These costs react on changes in the economic environment even if relative real government size remains constant. The

measure for nominal relative government size (the relative expenditures of the public sector) is defined as

$$g_n \equiv \frac{c_G(r,w)G}{pX} = \frac{c_G(1,\omega)}{c_X(1,\omega,A)}g \ .$$

The relative costs in relation to the relative real government size is a function of the relative wage rate, which in turn is determined by (4.10):

$$\frac{g_n}{g} = \frac{c_G(1,\omega)}{c_X(1,\omega,A)} \equiv \kappa(g,A,k) \ . \tag{4.11}$$

Proposition 4.2. *$\kappa(g,A,k)$ is a positive function of g, A and k.*

Proof. See Appendix 4.4.1. □

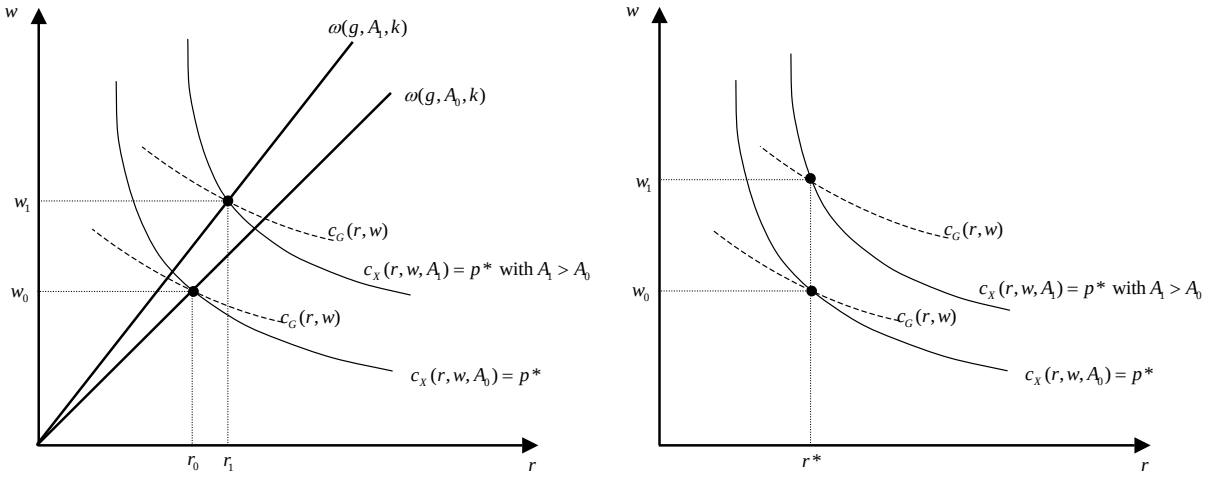
The intuition behind this proposition is as follows. Government expansion raises relative demand for labor which implies an increase in the relative wage rate for given factor endowments. Real expansion of the public sector implies a magnified nominal expansion since the relative costs in the public sector increase additionally. If capital markets are closed, an increase of the relative capital endowment implies a higher relative equilibrium wage rate and hence, higher relative costs in the public sector. This channel is pointed out in Gemmell (1987).[14] However, it is clear that if there is capital mobility and the factor price of capital is determined by the world interest rate, the relative wage rate is positively correlated with relative employment of capital and not with relative endowment. The effect of the transition from closed to integrated capital markets on the relative prices is discussed further below.

A higher productivity has a direct and indirect effect on the relative costs in public good production. In the private sector per unit costs are reduced and hence relative costs of the public sector increase (for given factor prices). This direct effect is the Baumol effect which is independent of relative factor intensities. Moreover, for a given g, public good production will increase as a response to a larger productivity in the private sector. This raises the relative wage rate and thus the per unit cost in the public sector (i.e. we have

[14] Also authors such as Kravis and Lipsey (1982) and Bhagwati (1984) argue that the relative wage rate and as such the relative price of non-tradables is higher in countries which are abundantly endowed with capital relative to labor.

a Balassa-Samuelson effect).[15] Note that when capital markets are integrated and the factor price of capital is determined by its world market price, higher productivity in the private sector leads - independent of preference assumptions and real government share - to a higher relative factor price of labor.[16] The effect of an increase in productivity is illustrated in the factor price diagram below (figure 4.4) for closed and integrated capital markets.

Figure 4.4: The effect of a productivity increase on factor prices



Capital market integration

In a small open economy with fully integrated capital markets, the interest rate is given by the world market. In this case ω is determined by the zero profit condition (4.4) and $r = r^*$. Hence, ω is independent of the real government share and preferences.[17] Nevertheless, transition from closed to open capital markets brings interesting insights for the relative nominal government size. Assume, for instance, that the autarky interest

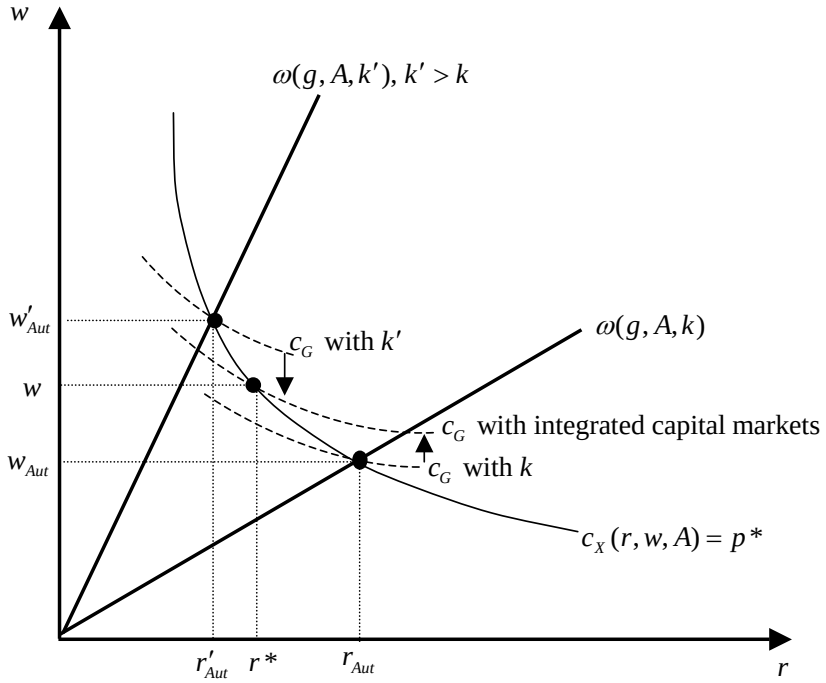
[15] In the case of Cobb-Douglas preferences (which implies a unitary price elasticity of demand) the relative factor prices are independent of productivity (see Appendix 4.4.2). Because of the direct effect, the positive effect of A on κ remains.

[16] That preferences do not matter for the Balassa-Samuelson effect when capital markets are integrated is emphasized by Obstfeld and Rogoff (1996).

[17] Note, when capital markets are integrated and there is either net capital inflow or outflow, a fraction of output X is exported or imported and $Q \neq X$. As a result, the ratio between public and private sector production is unequal to the ratio between public consumption to private consumption: $\frac{G}{X} = g \neq \frac{1}{\lambda} = \frac{G}{Q}$. However, the assumption about g and λ is irrelevant for this discussion.

rate is relatively high ($r > r^*$), that is, ω is low. Opening capital markets induces inflow of capital until the domestic interest rate equals the rate on the world market, $r = r^*$. As the analysis above has shown, an increase in relative capital endowment increases the relative wage rate and hence, the relative costs of public good production. The reverse results if the autarky interest rate is relatively low before opening capital markets. Globalization in terms of capital market integration may raise or decrease the relative size of the government, depending on the initial capital richness of the country. Capital rich countries with low interest rates will experience a capital outflow and a reduction in the relative wage rate and relative government expenditures decrease. A graphical illustration of the effect of capital market opening on the factor prices is provided in figure 4.5.

Figure 4.5: The effect of capital in- and outflow on factor prices



4.1.2 The Effect of Trade Liberalization on Nominal versus Real Government Share

In this section it is shown that trade liberalization can be responsible for a Balassa-Samuelson effect and a Baumol's cost disease in the public sector by raising average productivity in the private sector. In order to illustrate this channel it is assumed that

the private sector is characterized by heterogeneous firms according to Melitz (2003). I start to characterize the closed economy before the costly trade equilibrium is discussed.

Closed economy

The private sector of the economy delivers a homogeneous final output Y under perfect competition. Y is produced by differentiated intermediate inputs. The differentiated intermediate goods are supplied by a continuum of firms under monopolistic competition. The production function of the final output producer that uses the intermediate goods as the only inputs is given by

$$Y = \left[M^{-\frac{1}{\sigma}} \int_{v \in V} x(v)^{\frac{\sigma-1}{\sigma}} dv \right]^{\frac{\sigma}{\sigma-1}} , \ \sigma > 1 ,$$

where M is the measure of set V, representing the mass of available intermediate goods, and σ the constant elasticity of substitution between the varieties. As in Blanchard and Giavazzi (2003), and Egger and Kreickemeier (2009) the external scale effect is excluded in order to focus on the effect of trade liberalization on the productivity distribution of active firms. The price index corresponding to the final good Y is given by

$$P = \left[M^{-1} \int_{v \in V} p(v)^{1-\sigma} dv \right]^{\frac{1}{1-\sigma}} .$$

Profit maximization of the final goods producers leads to the following demand function for each intermediate variety

$$x(v) = Dp(v)^{-\sigma} , \tag{4.12}$$

with $D \equiv \frac{YP^{\sigma}}{M} = \frac{IP^{\sigma-1}}{M}$. I denotes nominal private consumption expenditure which is total expenditure minus taxes used for public good production.

Intermediate goods are produced by employing capital and labor. We follow Bernard et al. (2007) and assume that fixed and variable costs of the intermediate goods producer require both factors of production with identical factor intensity. Variable costs varies across firms and depend on firm specific productivity $A \in (0, \infty)$. A is drawn from a

lottery with distribution function $H(A)$. All firms face the same fixed overhead costs per period. The cost function reads

$$C_X = c_X(r, w, 1)f + c_X(r, w, A)x$$

where $f > 0$ denotes the units of output required for overhead fixed investment and x is output of a firm.[18] Note that $c_X(r, w, A) = \frac{c_X(r,w,1)}{A}$. Because of the fixed production costs, in equilibrium, each firm produces a different variety. Facing demand function (4.12), a monopolistic firm with productivity A charges a profit-maximizing price equal to a mark-up $(1 + \mu)$ times marginal costs:

$$p(A) = c_X(r, w, A)(1 + \mu)$$

where $\mu = \frac{1}{\sigma-1} > 0$.

A firms revenue is thus given by

$$rev(A) = D\left[c_X(r, w, A)(1 + \mu)\right]^{1-\sigma} \ . \tag{4.13}$$

Available income for private goods, price index and productivity affect demand for each variety positively and increase revenue. Revenue depends negatively on the government size as government spending affects available income for private goods negatively. It is obvious that relative revenue of two firms with productivity A' and A'' does only depend on their relative productivity: $\frac{rev(A')}{rev(A'')} = \left(\frac{A'}{A''}\right)^{\sigma-1}$.

The contribution margin is given by $p(A) - c_X(r, w, A) = p(A)\frac{\mu}{1+\mu}$ which implies for a firms profit[19]

$$\pi(A) = \frac{\mu}{1 + \mu} rev(A) - fc_X(r, w, 1) \ . \tag{4.14}$$

Following Melitz (2003) an "average" productivity level $\tilde{A}$ is defined so that aggregate variables are the same as if there were M identical firms with productivity $\tilde{A}$. That

[18] It is still assumed that output in the intermediate goods sector is produced by a linear-homogeneous production function F^X with $\frac{\partial F^X}{\partial K}, \frac{\partial F^X}{\partial L} > 0$ and $\frac{\partial^2 F^X}{\partial K^2}, \frac{\partial^2 F^X}{\partial L^2} < 0$.

[19] A realistic additional assumption would be that fixed costs decrease with average productivity in the market due to spillovers between firms. This assumption does not change aggregate and average variables. The only difference would be in the equilibrium number of firms and the output per firm.

means, the firm with productivity $\tilde{A}$ is the representative firm. For final output we have $Y = Mx(\tilde{A})$ which implies that output of the average firm equals the average output per firm. The price index simplifies to $P = p(\tilde{A})$, total revenue and profits are represented by $R = PY = Mrev(\tilde{A})$ and $\Pi = M\pi(\tilde{A})$. According to Melitz (2003), this average productivity is given as

$$\tilde{A} \equiv \left(\frac{1}{1 - H(A^*)} \int_{A^*}^{\infty} A^{\sigma-1} h(A) dA \right)^{\frac{1}{\sigma-1}} ,$$

where $H(A)$ is the productivity distribution and $h(A)$ the respective density function. A^* is the "cut-off" productivity defined by the zero profit condition. In other words A^* is the least productive firm in the market. We make use of the standard assumption that ex ante firm productivity is Pareto distributed, i.e. $H(A) = 1 - \left(\frac{b}{A}\right)^s$.[20] $b > 0$ is the minimum value of productivity and hence $A \geq b$. The variable s determines the skewness of the Pareto distribution. It is assumed that $s > \sigma - 1$ in order to ensure that the average productivity has a finite positive value. In this case average productivity is given by:

$$\tilde{A} = \left(\frac{s}{s - \sigma + 1} \right)^{\frac{1}{\sigma-1}} A^* . \tag{4.15}$$

Before a firm can produce, it must pay a fixed entry cost which is thereafter sunk. For simplicity it is assumed that the factor intensity of costs of entry and production are the same, so that entry costs take the form $f_e c_X(r, w, 1)$, $f_e > 0$. After paying this investment the firm draws a productivity level A from distribution $H(A)$. Each firm has one draw of an A-level which is fixed after entry. A firm starts to produce if $\pi(A) \geq 0$. Since profits are increasing in A, the cut-off productivity for successful entry is determined by the zero-profit condition $\pi(A^*) = 0$ which is equivalent to

$$rev(A^*) = \frac{1 + \mu}{\mu} f c_X(r, w, 1) . \tag{4.16}$$

Each firm which draws a productivity $A \geq A^*$ will produce, firms which draw a productivity below A^* exit immediately. Combining (4.16) with $rev(\tilde{A}) = \left(\frac{\tilde{A}}{A^*}\right)^{\sigma-1} rev(A^*)$

[20] The respective density function is $h(A) = s\frac{b^s}{A^{s+1}}$.

and $\pi(\tilde{A}) = rev(\tilde{A})\frac{\mu}{1+\mu} - fc_X(r,w,1)$ the zero profit condition can be written as $\pi(\tilde{A}) = \left(\left(\frac{\tilde{A}}{A^*}\right)^{\sigma-1} - 1\right) fc_X(r,w,1)$ with $\tilde{A}(A^*)$ according to (4.15). Hence the zero cut-off profit condition is given by

$$\pi(\tilde{A}) = fc_X(r,w,1)\frac{\sigma-1}{s-\sigma+1} \ . \tag{4.17}$$

The entry decision, that is, whether or not a firm invests $f_e c_X$ to get an ex ante uncertain productivity draw, is determined as follows. There is an infinite number of periods and if the firm starts to produce it faces an exogenous probability of death, δ, each period. As there is an unbounded pool of potential entrants, in equilibrium the expected value of entry - which is equal to the probability of a successful draw times the expected profitability of producing until death - must equal the sunk cost of entry:

$$\begin{aligned} \text{expected value of entry } &= \rho_{in}\frac{\pi(\tilde{A})}{\delta} \\ &= f_e c_X(r,w,1) = \text{sunk entry cost} \ , \end{aligned}$$

where $\rho_{in} \equiv 1 - H(A^*)$. Replacing ρ_{in} by $\left(\frac{b}{A^*}\right)^s$ for the Pareto distribution, the free entry condition reduces to

$$\pi(\tilde{A}) = \delta f_e c_X(r,w,1)\left(\frac{A^*}{b}\right)^s \ . \tag{4.18}$$

The zero cut-off profit (4.17) and the free entry condition (4.18) together determine the cut-off productivity A^* which is independent of the factor prices since the unit fixed costs of entry and production cancel out:[21]

$$A^* = b\left(\frac{f}{\delta f_e}\frac{\sigma-1}{s-\sigma+1}\right)^{\frac{1}{s}} \ . \tag{4.19}$$

The resource constraints will complete the characterization of the closed economy

[21] If fixed costs decrease with average productivity, the zero cut-off profit condition is given by $\pi(\tilde{A}) = fc_X(r,w,1)\,(A^*)^{-1}\left(\frac{s}{s-\sigma+1}\right)^{\frac{-1}{\sigma-1}}\frac{\sigma-1}{s-\sigma+1}$. Hence, it would be a downward sloping curve in the (A,π) space, since the fixed costs are decreasing in average productivity. The free entry condition is given by $\pi(\tilde{A}) = \delta f_e c_X(r,w,1)\left(\frac{s}{s-\sigma+1}\right)^{\frac{-1}{\sigma-1}}(A^*)^{-1}\left(\frac{A^*}{b}\right)^s$. It is downward sloping in the (A,π) space if $s<1$. For $s=1$ average profit is independent of the productivity and for $s>1$ it is upward sloping. As it is assumed that $s > \sigma - 1$ and estimates for σ are around 3 or even larger (see for example Bernard et al. (2003)), the free entry curve is most likely upward sloping. Note, that the assumption that fixed costs decrease with average productivity does not affect equilibrium cut-off productivity.

equilibrium. It is assumed that both factors of production are immobile between countries. Labor and capital market clearing requires that the resources used for total production (variable (L_v and K_v) and fixed (L_f and K_f) input) and entry (L_e and K_e) plus resources employed by the public sector (L_G and K_G) must be equal to the available resource stocks in the country.

$$L_v + L_f + L_e + L_G = \bar{L} \tag{4.20}$$

$$K_v + K_f + K_e + K_G = \bar{K} \; . \tag{4.21}$$

Denote by M_e the mass of entrants and by $\rho_{in} = 1 - H(A^*)$ the success rate. In steady state the mass of firms which are successful must equal the mass of firms which exit the market, that is $\rho_{in} M_e = \delta M$. It follows that $M_e = \frac{\delta M}{\rho_{in}}$. Therefore, the number of workers and capital needed to enter the market is given by $L_e = M_e f_e a_X(\omega, 1) = \frac{\delta M}{\rho_{in}} f_e a_X(\omega, 1)$ and $K_e = \frac{\delta M}{\rho_{in}} f_e b_X(\omega, 1)$. For variable and fixed costs of domestic production the requirement for labor and capital are $L_v = Mx(\tilde{A}) a_X(\omega, \tilde{A})$, $K_v = Mx(\tilde{A}) b_X(\omega, \tilde{A})$ and $L_f = M f a_X(\omega, 1)$, $K_f = M f b_X(\omega, 1)$.

Total revenue $R = Mrev(\tilde{A}) = Mp(\tilde{A}) x(\tilde{A})$ equals total costs (inclusive entry and fixed costs of production).[22] Hence, $Mp(\tilde{A}) x(\tilde{A}) = wL_X + rK_X$ with $L_X = L_v + L_f + L_e$ and $K_X = K_v + K_f + K_e$. The price and the total unit costs in the private sector are given by

$$p(\tilde{A}) = \frac{wL_X + rK_X}{Mx(\tilde{A})} \quad \Leftrightarrow \quad c_X(r, w, \tilde{A}) = \frac{wL_X + rK_X}{(1+\mu) Mx(\tilde{A})} \; .$$

Using the fact that $c_X(r, w, \tilde{A}) = a_X(\omega, \tilde{A}) w + b_X(\omega, \tilde{A}) r$, we can write

$$(1+\mu) Mx(\tilde{A}) a_X(\omega, \tilde{A}) w + (1+\mu) Mx(\tilde{A}) b_X(\omega, \tilde{A}) r = wL_X + rK_X$$

which implies for total private input of labor $L_X = (1+\mu) Mx(\tilde{A}) a_X(\omega, \tilde{A})$ and for total input of capital in private production $K_X = (1+\mu) Mx(\tilde{A}) b_X(\omega, \tilde{A})$. Hence, the resource

[22] Total profits will cover the total costs for entry $\Pi = M\pi(\tilde{A}) = wL_e + rK_e$ while total revenue minus profits cover total costs of production $R - \Pi = w(L_v + L_f) + r(K_v + K_f)$.

constraints can be written as

$$a_X(\omega, \tilde{A})(1+\mu)Y + a_G(\omega)G = \bar{L} \tag{4.22}$$

$$b_X(\omega, \tilde{A})(1+\mu)Y + b_G(\omega)G = \bar{K} \ . \tag{4.23}$$

Solving the resource constraints for G and Y we obtain the Rybczynski lines

$$Y = \frac{1}{a_X(\omega, \tilde{A})(1+\mu)} \frac{\bar{K} - k_G(\omega)\bar{L}}{k_X(\omega) - k_G(\omega)} \qquad \text{and} \qquad G = \frac{1}{a_G(\omega)} \frac{k_X(\omega)\bar{L} - \bar{K}}{k_X(\omega) - k_G(\omega)} \ .$$

The ratio between public good provision and private sector output is

$$g = \frac{G}{Y} = \frac{a_X(\omega, \tilde{A})(1+\mu)}{a_G(\omega)} \frac{k_X(\omega) - k}{k - k_G(\omega)} \tag{4.24}$$

which implies that the relative factor price is implicitly determined by real government size, average productivity and hence cut-off productivity, relative capital endowment and the mark-up: $\omega(g, \tilde{A}, k, \mu)$.[23] For given average productivity, a lower mark-up raises the relative factor price of labor. It is obvious from (4.24) that an increase in μ has exactly the opposite effect on ω compared to an increase in productivity.

The nominal government share is determined by $g_n = \frac{c_G G}{PY}$. For the ratio between relative costs (expenditures) of the public sector and real government share we have

$$\frac{g_n}{g} = \frac{c_G(1, \omega)}{c_X(1, \omega, \tilde{A})} \frac{1}{1+\mu} \equiv \kappa(g, \tilde{A}, k, \mu) \ . \tag{4.25}$$

We are back to equation (4.11) with one difference which is that the mark-up plays also an important role in determining the relative prices between the two sectors. Ceteris paribus, a higher mark-up in the private sector reduces the relative price of governments κ.

Open economy

We will now consider trade between $N+1$ identical countries each of which is modeled as described in the previous subsection. It is assumed that the final good is traded

[23] As $Q = Y$, we have $g = \frac{1}{\lambda}$.

frictionless, while trade in intermediates is costly.[24] An intermediate firm faces variable trade costs of the iceberg form where $\tau > 1$ units have to be shipped in order for 1 unit to arrive. As a result, the price in the export market is $p_{ex} = \tau p$. In addition, there are fixed per period beachhead costs f_{ex} to enter a foreign market. It is assumed that this fixed cost requires domestic resources with the same factor intensity as the other type of fixed costs.[25]

Because of symmetry, demand for a variety on a foreign market is given by $y_{ex} = \tau^{-\sigma} y_d$ where $y_d = p^{-\sigma} D$ is demand on the domestic market. Hence, an exporting firm's revenue from one export market is proportional to the domestic revenue:[26] $rev_{ex}(A) = \tau^{1-\sigma} rev_d(A)$ where $rev_d(A)$ coincides with the revenue in the closed economy. High transportation costs, i.e., more units are lost during transport, reduces relative revenue in the export market. Not every firm will serve the export market but if the firm exports, it exports to all N markets. Hence total revenue is given by

$$rev(A) = \begin{cases} rev_d(A) & \text{if firm does not export} \\ rev_d(A)\left[1 + \tau^{1-\sigma} N\right] & \text{if firm exports .} \end{cases}$$

An exporting firm obtains profits from each export market of $\pi_{ex} = \frac{\mu}{1+\mu} rev_{ex}(A) - f_{ex} c_X(r, w, 1)$. If $\pi_{ex}(A) \geq 0$, the firm exports to all N markets. A firm's profit can be written as

$$\pi(A) = \pi_d(A) + \max\{0, N\pi_{ex}(A)\} ,$$

where $\pi_d(A)$ corresponds to the profit in the closed economy (equation (4.14)).

In the open economy there are two cutoff productivities, one for successful entry (A^*) and one for exporting (denoted by A^*_{ex}). A firm with productivity A^* will make zero profit in the domestic market, a firm with productivity A^*_{ex} will make zero profit in the export markets and positive profit in the domestic market. The cutoff productivity for exporting

[24] We have $Q = Y$ since countries are identical. It is not important whether the final good is assumed to be tradable or not.

[25] For a similar assumption concerning equal factor intensity in production and fixed costs see Bernard et al. (2007).

[26] $\tau y_{ex} = \tau(\tau p)^{-\sigma} D$ units have to be shipped in order for y_{ex} units to arrive. Thus, revenue from one export market is given by $rev_{ex} = p_{ex} y_{ex}$.

is found by $\pi_{ex}(A^*_{ex}) = 0$

$$rev_{ex}(A^*_{ex}) = \frac{1+\mu}{\mu} f_{ex} c_X(r, w, 1) \ . \tag{4.26}$$

Together with $rev_{ex}(\tilde{A}_{ex}) = \left(\frac{\tilde{A}_{ex}}{A^*_{ex}}\right)^{\sigma-1} rev_{ex}(A^*)$, the zero profit condition for exporting can be reformulated as

$$\pi_{ex}(\tilde{A}_{ex}) = \left(\left(\frac{\tilde{A_{ex}}}{A^*_{ex}} \right)^{\sigma-1} - 1 \right) f_{ex} c_X(r, w, 1) \ . \tag{4.27}$$

Note that, $\tilde{A}_{ex}$ is the average productivity of exporting firms.

Using $c_X(r, w, A) = \frac{c_X(r,w,1)}{A}$, equations (4.13) and (4.16) can be solved for $A^* = \left(\frac{f}{\mu D}(c_X(r, w, 1)(1+\mu))^{\sigma}\right)^{\frac{1}{\sigma-1}}$ and similarly using (4.26) and $rev_{ex}(A) = \tau^{1-\sigma} rev_d(A)$ we obtain for cut-off productivity of exporting $A^*_{ex} = \tau \left(\frac{f_{ex}}{\mu D}(c_X(r, w, 1)(1+\mu))^{\sigma}\right)^{\frac{1}{\sigma-1}}$. We see that A^*_{ex} is proportional to A^*:

$$A^*_{ex} = \tau \left(\frac{f_{ex}}{f} \right)^{\frac{1}{\sigma-1}} A^* \ . \tag{4.28}$$

By assumption, a firm can only export if it is active in the domestic market. Moreover, exporting firms are more productive than non-exporting firms, that is, productivity of the marginal exporter is larger than cut-off productivity for the domestic market: $A^*_{ex} > A^*$. Let us assume that $f_{ex} \geq f$ which guarantees $\tau \left(\frac{f_{ex}}{f}\right)^{\frac{1}{\sigma-1}} > 1$ for all $\tau > 1$, this implies a selection of the more productive firms into the export market.

In equilibrium the expected value of entry must equal the sunk cost of entry:

$$\frac{1}{\delta}\left[(1 - H(A^*))\pi_d(\tilde{A}) + (1 - H(A^*_{ex}))N\pi_{ex}(\tilde{A}_{ex})\right] = f_e c_X(r, w, 1) \tag{4.29}$$

with $\pi_d(\tilde{A})$ and $\pi_{ex}(\tilde{A}_{ex})$ are the expected profit for the domestic market and for one export market respectively.

The free entry condition together with the zero cut-off productivity condition can be

written as[27]

$$f_e = \frac{1}{\delta}\left[(1-H(A^*))f\left(\left(\frac{\tilde{A}}{A^*}\right)^{\sigma-1}-1\right)+(1-H(A^*_{ex}))Nf_{ex}\left(\left(\frac{\tilde{A}_{ex}}{A^*_{ex}}\right)^{\sigma-1}-1\right)\right], \tag{4.30}$$

where

$$\tilde{A} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}} A^* \quad \text{and} \quad \tilde{A}_{ex} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}} A^*_{ex}\,.$$

$\tilde{A}$ is average productivity of all domestic firms producing either only for the domestic market or for both the domestic and foreign market. $\tilde{A}_{ex}$ is average productivity only of the exporting firms. Equation (4.30) together with (4.28) determine the cut-off productivity A^*. Solving for the cut-off productivity under the assumption that productivity is Pareto distributed[28] we obtain

$$A^* = b\left(\frac{f}{\delta f_e}\frac{\sigma-1}{s-\sigma+1}\left[1+N\left(\frac{f_{ex}}{f}\right)^{\frac{\sigma-1-s}{\sigma-1}}\tau^{-s}\right]\right)^{\frac{1}{s}}. \tag{4.31}$$

There are M firms active in a country. Their average productivity is $\tilde{A}$. The number of exporting firms is denoted by $M_{ex} = \rho_{ex}M$ where $\rho_{ex} = \frac{1-H(A^*_{ex})}{1-H(A^*)}$ is the ex ante probability of exporting conditional on successful entry. The average productivity of an exporting firm is denoted by $\tilde{A}_{ex}$. Hence, total number of firms competing in the domestic market, that is also the mass of intermediate goods available for production of the final good, is given by $M_t = (1+\rho_{ex}N)M$. The average productivity of these firms is denoted by $\tilde{A}_t = \left[M_t^{-1}\left(M\tilde{A}^{\sigma-1} + NM_{ex}(\tau^{-1}\tilde{A}_{ex})^{\sigma-1}\right)\right]^{\frac{1}{\sigma-1}}$. Note that the productivity of foreign firms are corrected by the trade costs τ. The average productivity of all firms competing in the domestic market can be written as $\tilde{A}_t = \left[\frac{1+N\rho_{ex}\frac{f_{ex}}{f}}{1+N\rho_{ex}}\right]^{\frac{1}{\sigma-1}}\tilde{A}$.[29] The private sector price index in the open economy is a weighted average of prices of all available goods

[27] Replace $\pi_d(\tilde{A}) = \left(\left(\frac{\tilde{A}}{A^*}\right)^{\sigma-1}-1\right)fc_X(r,w,1)$ and $\pi_{ex}(\tilde{A}_{ex}) = \left(\left(\frac{\tilde{A}_{ex}}{A^*_{ex}}\right)^{\sigma-1}-1\right)f_{ex}c_X(r,w,1)$ in (4.29) to obtain (4.30).

[28] We use $\frac{\tilde{A}}{A^*} = \frac{\tilde{A_{ex}}}{A^*_{ex}} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}}$, (4.28) and $1-H(A) = \left(\frac{b}{A}\right)^s$.

[29] Using the fact that $\tilde{A} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}}A^*$, $\tilde{A}_{ex} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}}A^*_{ex}$ and $A^*_{ex} = \tau\left(\frac{f_{ex}}{f}\right)^{\frac{1}{\sigma-1}}A^*$, we can write $\tilde{A}_t = \left[M_t^{-1}\left(M\tilde{A}^{\sigma-1} + NM_{ex}(\tau^{-1}\tilde{A}_{ex})^{\sigma-1}\right)\right]^{\frac{1}{\sigma-1}} = \left[\frac{1+N\rho_{ex}\frac{f_{ex}}{f}}{1+N\rho_{ex}}\right]^{\frac{1}{\sigma-1}}\tilde{A}$.

(domestic and imported varieties from N countries), that is, M goods at a price $p(\tilde{A})$ and $N\rho_{ex}M$ varieties at a price $\tau p(\tilde{A}_{ex})$:

$$P = \left[M_t^{-1} \left(M(p(\tilde{A}))^{1-\sigma} + N\rho_{ex} M \left(\tau p(\tilde{A}_{ex}) \right)^{1-\sigma} \right) \right]^{\frac{1}{1-\sigma}} .$$

It is equivalent to $P = p(\tilde{A}_t)$ (see Appendix 4.4.2 for the derivation). Note that if the fixed costs of exporting are equal to the fixed costs of domestic production $f_{ex} = f$ we have $\tilde{A}_t = \tilde{A}$ which is that the average productivity of competing firms is equal to the average productivity in the domestic market. Aggregate private supply in a country is determined by $Y = M_t x(\tilde{A}_t)$ and aggregate revenue $R = PY = M_t p(\tilde{A}_t) x(\tilde{A}_t) = M_t rev(\tilde{A}_t)$.[30] In the open economy, additional resources are required for exporting. Hence, total employment of capital in the private sector is given by $L_X = L_v + L_f + L_{ex} + L_e$ and $K_X = K_v + K_f + K_{ex} + K_e$ respectively. We have $L_v = Y a_X(\omega, \tilde{A}_t)$, $K_v = Y b_X(\omega, \tilde{A}_t)$, $L_e = \frac{\delta M}{\rho_{in}} f_e a_X(\omega, 1)$, $K_e = \frac{\delta M}{\rho_{in}} f_e b_X(\omega, 1)$, $L_f = M f a_X(\omega, 1)$, $K_f = M f b_X(\omega, 1)$. For fixed costs of exporting an amount of labor, $L_{ex} = M\rho_{ex} N f_{ex} a_X(\omega, 1)$, and capital, $K_{ex} = M\rho_{ex} N f_{ex} b_X(\omega, 1)$, is required.

Total revenue in the private sector has to be equal to total costs in the private sector $PY = wL_X + rK_X$ which can be written as

$$c_X(r, w, \tilde{A}_t)(1+\mu)Y = w(L_v + L_f + L_{ex} + L_e) + r(K_v + K_f + K_{ex} + K_e) .$$

Using $c_X(r, w, \tilde{A}_t) = a_X(\omega, \tilde{A}_t)w + b_X(\omega, \tilde{A}_t)r$ we can write demand for labor and capital in the private sector as $L_X = (1+\mu)Y a_X(\omega, \tilde{A}_t)$ and $K_X = (1+\mu)Y b_X(\omega, \tilde{A}_t)$ with $Y = M_t x(\tilde{A}_t)$.[31] The resource constraints can be written as follows:

$$a_X(\omega, \tilde{A}_t)(1+\mu)Y + a_G(\omega)G = \bar{L} , \tag{4.32}$$

$$b_X(\omega, \tilde{A}_t)(1+\mu)Y + b_G(\omega)G = \bar{K} . \tag{4.33}$$

[30] Using equation (4.13) and $\tilde{A}_t = \left[\frac{1+N\rho_{ex}\frac{f_{ex}}{f}}{1+N\rho_{ex}} \right]^{\frac{1}{\sigma-1}} \tilde{A}$ we can also write $R = M(1+N\rho_{ex}\frac{f_{ex}}{f}) rev(\tilde{A})$.

[31] The mark-up captures the amount of capital and labor used for the three type of fixed costs. This implies that $\mu Y = M\tilde{A}_t(f + \rho_{ex} N f_{ex} + \frac{\delta}{\rho_{in}} f_e)$.

The two equations can be combined to

$$g = \frac{G}{Y} = \frac{a_X(\omega, \tilde{A}_t)(1+\mu)}{a_G(\omega)} \frac{k_X(\omega) - k}{k - k_G(\omega)} \,. \tag{4.34}$$

Again, the relative wage rate ω is implicitly determined as a function of $\tilde{A}_t$, k, g and μ, $\omega(g, \tilde{A}_t, k, \mu)$.[32] The relative price level is given by

$$\kappa = \frac{c_G(1, \omega)}{c_X(1, \omega, \tilde{A}_t)(1+\mu)} \,.$$

Trade liberalization

This subsection analyzes the effects of trade liberalization on the relative costs of public good production. Lemma 4.2 recapitulates the effects of trade liberalization on average productivity provided by Melitz (2003).

Lemma 4.2. *Trade liberalization (a reduction in transportation costs τ, an increase in the number of trading partners N or lower fixed costs of exporting f_{ex}) raises average productivity $\tilde{A}_t$.*

Proof. Lemma 4.2 follows directly from (4.31), (4.15), (4.28) and $\tilde{A}_t = \left[\frac{1+N\rho_{ex}\frac{f_{ex}}{f}}{1+N\rho_{ex}}\right]^{\frac{1}{\sigma-1}} \tilde{A}$ with $\rho_{ex} = \left(\frac{A^*_{ex}}{A^*}\right)$. (See also Melitz, 2003.)

□

Together with the analyzes of the effects of productivity on relative prices, the following Propositions result immediately.

Proposition 4.3. *Trade liberalization raises the relative factor price ω.*

Proof.

$$\frac{\partial \omega}{\partial \tau} = \frac{\partial \omega}{\partial \tilde{A}_t} \frac{\partial \tilde{A}_t}{\partial \tau} < 0 \,, \qquad \frac{\partial \omega}{\partial f_{ex}} = \frac{\partial \omega}{\partial \tilde{A}_t} \frac{\partial \tilde{A}_t}{\partial f_{ex}} < 0 \,, \qquad \frac{\partial \omega}{\partial N} = \frac{\partial \omega}{\partial \tilde{A}_t} \frac{\partial \tilde{A}_t}{\partial N} > 0$$

Use Lemma 4.2 and Proposition 4.1. □

[32] See Appendix 4.4.3 for solving for all other variables in the equilibrium.

Proposition 4.4. *Trade liberalization raises the relative price in the public sector κ.*

Proof.

$$\begin{aligned}
\frac{\partial \kappa}{\partial \tau} &= \frac{\partial \kappa}{\partial \tilde{A}_t}\frac{\partial \tilde{A}_t}{\partial \tau} + \frac{\partial \kappa}{\partial \omega}\frac{\partial \omega}{\partial \tau} < 0 \,, \\
\frac{\partial \kappa}{\partial f_{ex}} &= \frac{\partial \kappa}{\partial \tilde{A}_t}\frac{\partial \tilde{A}_t}{\partial f_{ex}} + \frac{\partial \kappa}{\partial \omega}\frac{\partial \omega}{\partial f_{ex}} < 0 \,, \\
\frac{\partial \kappa}{\partial N} &= \frac{\partial \kappa}{\partial \tilde{A}_t}\frac{\partial \tilde{A}_t}{\partial N} + \frac{\partial \kappa}{\partial \omega}\frac{\partial \omega}{\partial N} > 0
\end{aligned}$$

according to the proof of Proposition 4.2 and Lemma 4.2. □

An increase in the average productivity raises the relative wage rate which leads to a higher relative price in the public sector and to an increase in the relative public budget share. Figure 4.6 illustrates the effect of trade liberalization on private (inclusive set up investment) and public production. Trade liberalization increases average productivity and the production possibilities frontier (PPF) rotates outwards since for given factor inputs in the private sector private production increases. Keeping the real relative government size g constant, the new equilibrium is determined by the intersection between $g\frac{1}{1+\mu}$ and the exterior curve. In the new equilibrium the slope is flatter which implies that the costs of government relative to the private sector must be higher.[33] Let us choose the aggregate price $P = p(\tilde{A}_t)$ as the numéraire. We see that the relative wage has to increase. The effect of trade liberalization in the factor price diagram for a given aggregate price P is provided in figure 4.7. The higher ω implies that both the private and public sector produce more capital intensive. Since average productivity in the private sector increases, its unit cost curve is shifted outward. This pushes up unit cost in the public sector which cannot compensate the rising factor prices by productivity growth. How trade liberalization affects employment of the two factors in the two sectors can be best illustrated in the Edgeworth box (see figure 4.8). Employment of capital and labor in the public sector increase while employment of both input factors in the private sector decrease and both sectors produce more capital intensive.

[33] Note that the slope of the curve in figure 4.6 is $-\frac{c_X}{c_G}$. The 'price' of the 'good' on the horizontal axis is c_X.

Figure 4.6: The effect of trade liberalization on production

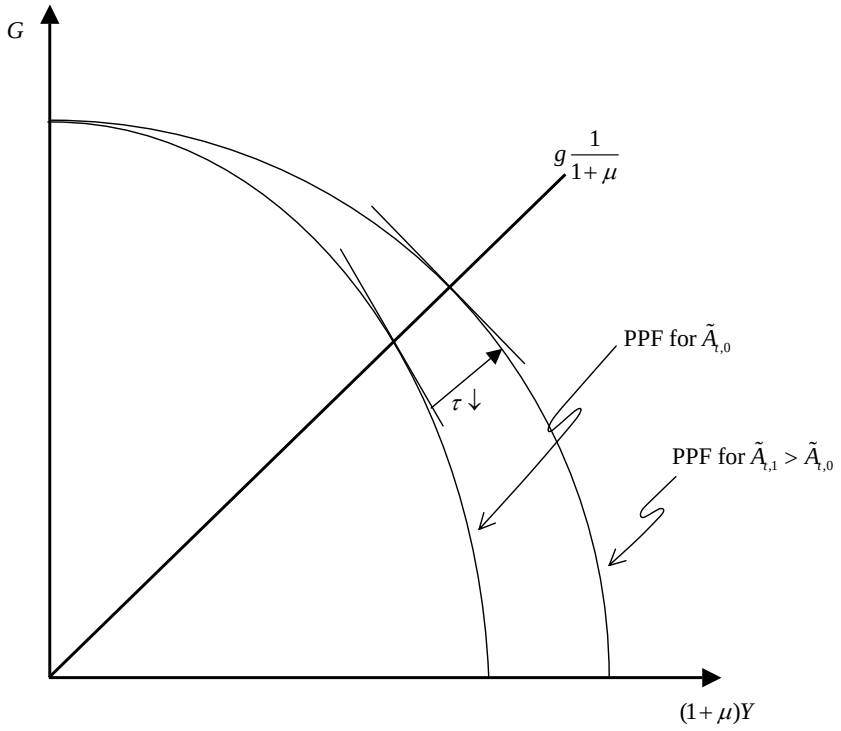


Figure 4.7: The effect of trade liberalization on factor prices

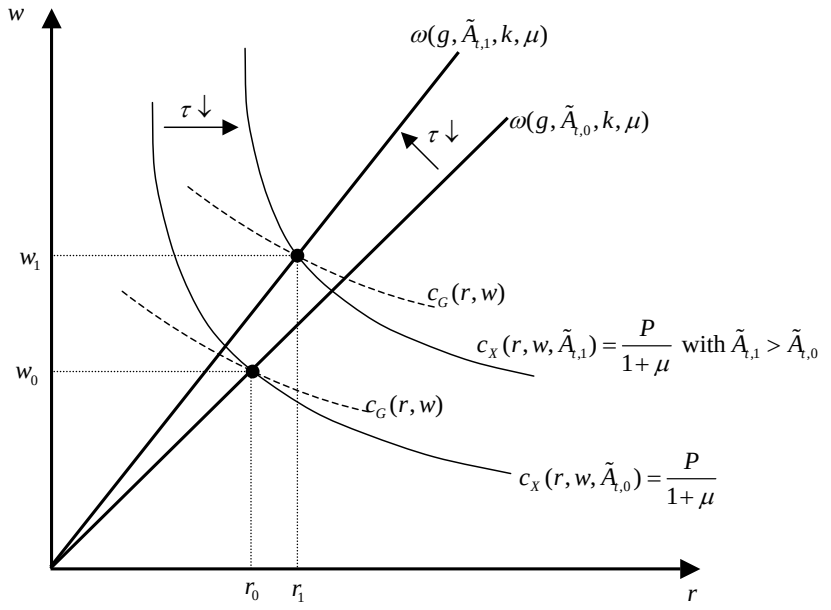
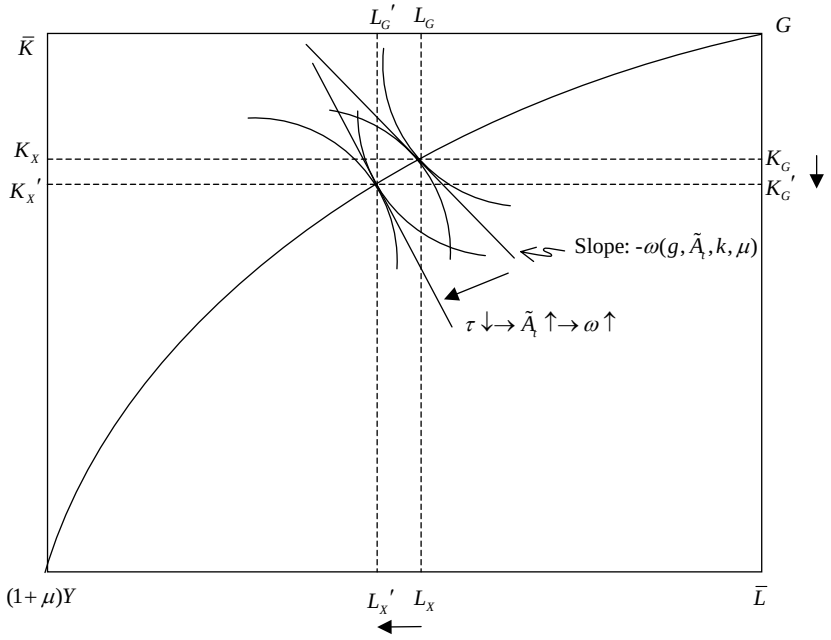


Figure 4.8: The effect of trade liberalization on factor employment



4.2 Empirical Evidence

The following two hypotheses from the theoretical models are going to be investigated empirically.

(I) *Net capital inflow has a positive effect on the unit costs of the public sector relative to the private sector price.*

(II) *Trade liberalization has a positive effect on the unit costs of the public sector relative to the private sector price.*

The data are obtained from various sources. For relative unit costs, that is denoted by κ in the model, two different measures are taken. A first variable will be the relative price levels of government versus the price level of GDP. A second measure is the government consumption share measured at current prices relative to the government consumption share at constant price (nominal versus real government share). From the theoretical point of view the two measures should be identical

$$\kappa = \frac{c_G}{p} = \frac{g_n}{g} \, .$$

In the data, however, the two measures are not correlated. For robustness checks the results for both endogenous variables are always provided.

The price levels of government versus the price level of GDP is denoted by p_G/p_{GDP} the government consumption share at current prices relative to the one at constant price is denoted by gov_{cur}/gov (from Heston et al. (2006) PWT 6.2).[34] For the explanatory variables concerning the capital market we have net foreign direct investment inflows (*FDInetinflow*) derived from the International Financial Statistics (IFS) provided by IMF. Net FDI inflow is a close measure to the model as capital is thought to be production capital. Nevertheless, also results for a more aggregate net financial inflow, the capital account *CA* (also derived from the IFS) are provided. Two measures are used

[34]That the version of PWT may matter for the results we know at the latest from Ponomareva and Katayama (2010). Here, also different results are obtained with the newest version of PWT 6.3, namely: FDI net inflow are alleviated and insignificant and in return the trade freedom index is found to be positively significant in the $\frac{gov_{cur}}{gov}$ regression. We have chosen to take PWT 6.2 instead of 6.3 as the authors suggest to wait for PWT 7.0 (see "What is new in PWT 6.3").

for trade liberalization: on the one hand the average applied tariff rates (*tariff*) provided by the World Bank and on the other hand the Trade Freedom index from the Heritage Foundation and Wall Street Journal (*tradefreedom*). The Trade Freedom index is based on trade-weighted average tariff rates and on non-tariff barriers. Population (*pop*), *gdp* and *openness* are also derived from PWT 6.2. The urbanization rate (*urban*) and the dependency ratio (*depend*) are from the World Development Indicators (World Bank). Moreover, it is controlled for the political regime (*polity2* from the Polity IV dataset), whether the country was affected by violence or wars (*war* from MEPV) and black market premium (*blackpremium* from the Development Research Institute).[35] The result is an unbalanced panel of yearly data for the time span 1970-2004. All the regressions are executed with country and time fixed effects and standard errors are robust. The three variables *gov*, *gdp* and *openness* are lagged by one period.[36]

Tables 4.1 to 4.4 present the results for net capital inflow. When all controls are taken into account the number of observations is reduced noticeably because black market premium is only available until 1999. There is only partial evidence for hypothesis (I). Table 4.1 presents the results for a sample of 120-163 countries. The relative price level is not significantly affected by net FDI inflow. Significantly positive effects are obtained for the nominal versus real government share regression (columns (4)-(6)). The estimation for net FDI inflow is positively significant at the 1% level and the estimation of net FDI inflow lagged one period is positively significant at the 10% level. Table 4.2 provides the results for 26-30 OECD countries. Except in column (1) and (6) the estimations for (lagged) net FDI inflow are significantly positive.

The estimations for the effect of the capital account are provided in tables 4.3 and 4.4. The estimations for the effect on the relative price levels are (mostly) significantly positive at the 1% level in both the large country sample and the subset of OECD countries. The regressions for the effect on the nominal versus real government share look different. In both country samples these effects of the capital account are negatively significant.

The time series for the trade measures are much shorter. The trade freedom measure starts in 1995 and the earliest average tariffs are available for 1981. The results for trade

[35] A complete list of the variable description and sources is provided in table 4.9.

[36] The estimates are quite similar whether the explanatory variables are lagged or contemporaneous.

liberalization are mixed (tables 4.5 to 4.8). According to table 4.5 there is no evidence for hypothesis (II) in the pooled regression of the large country sample. The OECD sample, however, shows significant and positive effects of *tradefreedom* on the relative price level of governments (column (1)-(3) in table 4.6). The estimations are slightly negative but insignificant when the endogenous variable is nominal versus real government consumption. Only *tradefreedom* lagged one period shows a weakly significant negative effect at the 10% level. No evidence for the hypothesis (II) is found in the tariff regressions (table 4.7 and 4.8) which show mostly nonsignificant estimates.

The measures for trade liberalization are far from perfect. As import tariffs are an important source for financing government spending in developing countries, it is very likely an endogenous variable. Also, tariffs are hard to measure and to aggregate. Since the variable *tradefreedom* captures not only tariffs but also non-tariff barriers it seems to be a slightly better measure.

The empirical results show that the real government share is mostly negatively correlated with the relative price levels. An explanation for the negative correlation found in the data might be the endogeneity of the government share. Higher prices of the public good will lead to a reduction in real consumption share if there is some degree of a price elasticity of demand. As the main purpose is to give some tentative evidence I am not going to deal with the endogeneity issue here except that the variable is lagged. Excluding the potentially endogenous variable "real government size" on the right hand side does hardly change the estimation results (results not reported).[37]

Since richer countries have higher national price levels, we would expect that for given population a higher GDP is positively correlated with relative prices of governments. In tables 4.1 to 4.4 most of the relative price level regression show this pattern. In columns (4) to (6) in most tables, we do not find this effect. Also in columns (1)-(3) in tables 4.6 and 4.8 GDP has mostly a negative effect on relative prices of governments.

[37]The biggest difference when *gov* is excluded is that the estimates of the capital account in table 4.3 lose their negative significance.

4.3 Conclusion

This chapter identifies a so far neglected channel how globalization can explain an increase in government expenditure shares. It is refrained from political decisions on public good provision and the real government share is kept constant. Doing so the effects of globalization on the costs of public good production relative to the private sector can be isolated without influence due to changes in the real share. The effects of two features of globalization are considered: international capital flows and trade liberalization.

It is found that capital inflow leads to a higher relative wage rate and to higher relative costs in the labor intensive public sector. As a result, the nominal government share increases as real government share is constant. Capital outflow has exactly the opposite effect. There is some empirical evidence which supports this hypothesis. Net FDI inflow has a positive effect on the nominal versus real government consumption share. Furthermore, the relative price levels between governments and GDP for OECD countries depend positively on net FDI inflows.

Moreover, in the Melitz framework, trade liberalization increases average productivity in the private sector which leads to a rise in the relative unit costs in the public sector. Furthermore, for given real government size, the relative wage rate increases which additionally pushes up the costs of public good provision relative to the price of private goods. In order to test this prediction average tariffs and the Trade Freedom index are used as a measure for trade liberalization. The results are mixed with not much evidence for the prediction. The only support for the hypothesis is obtained for OECD countries. There it is found that the trade freedom index has a positive effect on the relative price level of governments (relative to price level of GDP).

The empirical evidence provided in this chapter is rather preliminary. It might be taken as a starting point for more detailed empirical investigations. On the one hand, one may tackle the endogeneity issue and look at different and probably more suitable measures for trade liberalization. On the other hand, one can investigate the correlation with different estimation methods.

4.4 Appendix

4.4.1 Proof of Lemma 4.1 and Proposition 4.2

Proof of Lemma 4.1

Using the fact that $k_X(\omega) = b_X(\omega, A)/a_X(\omega, A)$ and $k_G(\omega) = b_G(\omega)/a_G(\omega)$ we can rewrite expression (4.9) as

$$\Gamma(\omega, k, A) = \frac{b_X(\omega, A) - a_X(\omega, A)k}{a_G(\omega)k - b_G(\omega)} \ .$$

It follows

$$\frac{\partial \Gamma}{\partial \omega} = \frac{\left(\frac{\partial b_X}{\partial \omega} - \frac{\partial a_X}{\partial \omega}k\right)(a_G k - b_G) - (b_X - a_X k)\left(\frac{\partial a_G}{\partial \omega}k - \frac{\partial b_G}{\partial \omega}\right)}{(a_G k - b_G)^2} \ .$$

Hence, $\frac{\partial \Gamma}{\partial \omega} > 0$ is equivalent to

$$\left(\frac{\partial b_X}{\partial \omega} - \frac{\partial a_X}{\partial \omega}k\right)(a_G k - b_G) > (b_X - a_X k)\left(\frac{\partial a_G}{\partial \omega}k - \frac{\partial b_G}{\partial \omega}\right) \ ,$$

which holds since $\frac{\partial b_i}{\partial \omega} > 0$, $\frac{\partial a_i}{\partial \omega} < 0$, $a_G k - b_G > 0$ and $b_X - a_X k > 0$ (because of $k_X > k > k_G$). The left hand side of the inequality is positive while the right hand side is negative.

Moreover,

$$\frac{\partial \Gamma}{\partial k} = \frac{a_X a_G\left(\frac{b_G}{a_G} - \frac{b_X}{a_X}\right)}{(a_G k - b_G)^2} < 0$$

since $\frac{b_G}{a_G} = k_G < k_X = \frac{b_X}{a_X}$. And

$$\frac{\partial \Gamma}{\partial A} = \frac{\frac{\partial a_X}{\partial A}(k_X - k)}{a_G(k - k_G)} < 0$$

since $k_X > k > k_G$ and $\frac{\partial a_X}{\partial A} < 0$. (Note that k_X is invariant with respect to A.)

Proof of Proposition 4.2

$$\frac{\partial \kappa}{\partial \omega} = \frac{\frac{\partial c_G(1,\omega)}{\partial \omega}c_X(1, \omega, A) - \frac{\partial c_X(1,\omega,A)}{\partial \omega}c_G(1, \omega)}{(c_X(1, \omega, A))^2}$$

It follows that (making use of Shepard's Lemma ($\frac{\partial c_i}{\partial w} = a_i$, $i = G, X$))

$$\frac{\partial \kappa}{\partial \omega} > 0 \Leftrightarrow a_G(wa_X + rb_X) > a_X(wa_G + rb_G)$$
$$\Leftrightarrow a_G b_X > a_X b_G \Leftrightarrow k_X > k_G \; .$$

Further, according to Proposition 4.1 we have

$$\frac{\partial \kappa}{\partial g} = \frac{\partial \kappa}{\partial \omega}\frac{\partial \omega}{\partial g} > 0 \quad \text{and} \quad \frac{\partial \kappa}{\partial k} = \frac{\partial \kappa}{\partial \omega}\frac{\partial \omega}{\partial k} > 0 \; .$$

Moreover,

$$\frac{\partial \kappa}{\partial A} = \frac{\partial \kappa}{\partial \omega}\frac{\partial \omega}{\partial A} - \frac{\frac{\partial c_X}{\partial A} c_G}{(c_X)^2} > 0$$

because of $\frac{\partial c_X}{\partial A} < 0$.

4.4.2 Derivations

Cost Minimal Input Coefficients

Assuming that the production function $j = A_j F^j(K_j, L_j)$, $j = X, G$, is linear-homogeneous. Then, $\frac{\partial F^j(K_j, L_j)}{\partial K} = F^j_K(K_j, L_j)$ and $\frac{\partial F^j(K_j, L_j)}{\partial L} = F^j_L(K_j, L_j)$ are homogeneous of degree zero. Cost minimal factor combination is given by the condition

$$\omega = \frac{F^j_L(k_j, 1)}{F^j_K(k_j, 1)} = MRTS^j(k_j)$$

where $\omega = w/r$ and $k_j = K_j/L_j$. This determines relative factor input $k_j(\omega)$. Using $L_j = \frac{j}{A_j(F^j(k_j,1))}$ and $K_j = \frac{j}{A_j(F^j(1,1/k_j))}$ the unit cost function ($c_j = r\frac{K_j}{j} + w\frac{L_j}{j}$) can be written as

$$c_j = \frac{1}{A_j}(F^j(k_j, 1))^{-1} w + \frac{1}{A_j}(F^j(1, \frac{1}{k_j}))^{-1} r \; .$$

Thus, the cost minimal input coefficients are $a_j(\omega, A_j) = \frac{1}{A_j}(F^j(k_j(\omega), 1))^{-1}$ and $b_j(\omega, A_j) = \frac{1}{A_j}(F^j(1, \frac{1}{k_j(\omega)}))^{-1}$. Note that $\frac{b_j(\omega, A_j)}{a_j(\omega, A_j)} = \frac{F^j(k_j(\omega),1)}{F^j(1,1/k_j(\omega))} = k_j(\omega)$.

Rybczynski Lines

Solving the capital market clearing condition (4.6) for G and replacing in (4.5) results in $a_X(\omega, A)X + a_G(\omega)(\bar{K} - b_X(\omega, A)X)\frac{1}{b_G(\omega)} = \bar{L}$. With some rearranging we obtain

$$X = \frac{1}{a_X(\omega, A)} \frac{\frac{b_G(\omega)}{a_G(\omega)}\bar{L} - \bar{K}}{\frac{b_G(\omega)}{a_G(\omega)} - \frac{b_X(\omega,A)}{a_X(\omega,A)}} = \frac{1}{a_X(\omega, A)} \frac{\bar{K} - k_G(\omega)\bar{L}}{k_X(\omega) - k_G(\omega)}$$

where we used $\frac{b_G(\omega)}{a_G(\omega)} = k_G(\omega)$ and $\frac{b_X(\omega,A)}{a_X(\omega,A)} = k_X(\omega)$. Replacing X in $G = [\bar{L} - a_X(\omega, A)X]\frac{1}{a_G(\omega)}$ we get

$$G = \frac{1}{a_G(\omega)} \left[\bar{L} - \frac{\frac{b_G(\omega)}{a_G(\omega)}\bar{L} - \bar{K}}{\frac{b_G(\omega)}{a_G(\omega)} - \frac{b_X(\omega,A)}{a_X(\omega,A)}} \right] = \frac{1}{a_G(\omega)} \frac{k_X(\omega)\bar{L} - \bar{K}}{k_X(\omega) - k_G(\omega)} .$$

Cobb-Douglas Preferences

With Cobb-Douglas preferences over the public and private output, relative expenditure shares and hence nominal government share g_n are constant. Combining $g_n = \frac{c_G}{p} g$ with $g = \frac{a_X}{a_G}\frac{k_X - k}{k - k_G}$ and using $c_i = a_i w + b_i r$ and $\frac{b_i}{a_i} = k_i,\ i = G, X$ leads to

$$g_n = \frac{c_G}{c_X}\frac{a_X}{a_G}\frac{k_X - k}{k - k_G} = \frac{\omega + k_G}{\omega + k_X}\frac{k_X - k}{k - k_G} .$$

This expression implicitly determines relative factor prices $\omega(g_n, k)$ which will be independent of productivity. We have

$$\frac{\partial \omega}{\partial k} = \frac{(\omega + k_G)(\omega + k_X)}{(k_X - k)(k - k_G)} > 0$$

as $k_X > k > k_G$. Moreover,

$$\frac{\partial \omega}{\partial g_n} = \frac{(\omega + k_X)^2(k - k_G)}{(k_X - k)(k_X - k_G)} > 0 .$$

An increase in the relative expenditure share for public goods raises relative factor price of labor.

According to the proof of Proposition 4.2, the effect of productivity A on κ is still positive: $\frac{\partial \kappa}{\partial A} = -\frac{\frac{\partial c_X}{\partial A} c_G}{(c_X)^2} > 0$.

Open Economy Price Index

The aggregate price in the open economy is given by

$$P = \left[M_t^{-1} \left(M(p(\tilde{A}))^{1-\sigma} + N\rho_{ex} M \left(\tau p(\tilde{A}_{ex}) \right)^{1-\sigma} \right) \right]^{\frac{1}{1-\sigma}} .$$

Using $p(\tilde{A}) = \tilde{A}^{-1} c_X(r, w, 1)(1+\mu)$ and $p(\tilde{A}_{ex}) = \tilde{A}_{ex}^{-1} c_X(r, w, 1)(1+\mu)$, the price index can be written as

$$\begin{aligned} P &= \left[M_t^{-1} \left(c_X(r, w, 1)(1+\mu) \right)^{1-\sigma} \left(M(\tilde{A}^{-1})^{1-\sigma} + N\rho_{ex} M \left(\tau \tilde{A}_{ex}^{-1} \right)^{1-\sigma} \right) \right]^{\frac{1}{1-\sigma}} \\ &= c_X(r, w, 1)(1+\mu) \left[M_t^{-1} \left(M\tilde{A}^{\sigma-1} + N\rho_{ex} M \left(\tau^{-1} \tilde{A}_{ex} \right)^{\sigma-1} \right) \right]^{\frac{1}{1-\sigma}} . \end{aligned}$$

Use $\tilde{A}_t = \left[M_t^{-1} \left(M\tilde{A}^{\sigma-1} + N\rho_{ex} M (\tau^{-1} \tilde{A}_{ex})^{\sigma-1} \right) \right]^{\frac{1}{\sigma-1}}$ to write

$$\begin{aligned} P &= c_X(r, w, 1)(1+\mu) \tilde{A}_t^{-1} \\ &= p(\tilde{A}_t) . \end{aligned}$$

4.4.3 Solving the Equilibrium

Closed Economy

Note that we cannot explicitly solve for the variables without simulations. In the following the equilibrium is summarized and described how one would proceed to solve for the endogenous variables.

The cut-off productivity, A^*, is determined by equation (4.19). Hence, we have average productivity, $\tilde{A}$, according to (4.15). The resource constraints, equations (4.22) and (4.23), together with $G = gY$ determine $\omega(g, \tilde{A}, k)$, $G(g, \tilde{A}, k)$ and $Y(g, \tilde{A}, k)$. Normalizing the aggregate price $P = c_X(r, w, \tilde{A})(1+\mu) = 1$, we have $r(\omega)$ and $w(\omega)$. Given r and w we have average revenue, $rev(\tilde{A}) = \frac{s}{s-\sigma+1} \frac{1+\mu}{\mu} f c_X(r, w, 1)$, and average profit, $\pi(\tilde{A}) = \frac{\sigma-1}{s-\sigma+1} f c_X(r, w, 1)$. R follows from $R = PY = Y(\omega)$. Note that as $P = 1$ we have $x(\tilde{A}) = rev(\tilde{A})$. Because $R = M rev(\tilde{A})$, we obtain M, and the number of firms which enter the market is $M_e = \frac{\delta M}{\rho_{in}}$ with $\rho_{in} = \left(\frac{b}{A^*} \right)^s$. We obtain L_X, K_X, K_G, L_G, L_e, L_f, L_v, K_e, K_f

and K_v according to

$$\begin{aligned} L_G &= Ga_G(\omega) & K_G &= Gb_G(\omega) \\ L_X &= (1+\mu)Ya_X(\omega,\tilde{A}) & K_X &= (1+\mu)Yb_X(\omega,\tilde{A}) \\ L_e &= \frac{M\delta}{\rho_{in}} f_e a_X(\omega,1) & K_e &= \frac{M\delta}{\rho_{in}} f_e b_X(\omega,1) \\ L_f &= Mf a_X(\omega,1) & K_f &= Mf b_X(\omega,1) \\ L_v &= Y a_X(\omega,\tilde{A}) & K_v &= Y b_X(\omega,\tilde{A})\ . \end{aligned} \tag{4.35}$$

Open Economy

Equation (4.31) determines the cut-off productivity, A^*. According to (4.15) and (4.28) we have average productivity of domestic firms, $\tilde{A}$, and the cut-off productivity for exporting, A^*_{ex}. We obtain the probabilities $\rho_{in} = \left(\frac{b}{A^*}\right)^s$ and $\rho_{ex} = \left(\frac{A^*_{ex}}{A^*}\right)^s$. Hence, we have average productivity of competing firms in the domestic market $\tilde{A}_t = \left[\frac{1+N\rho_{ex}\frac{f_{ex}}{f}}{1+N\rho_{ex}}\right]^{\frac{1}{\sigma-1}} \tilde{A}$. Using (4.32) and (4.33) together with $G = gY$ we obtain $\omega(g,\tilde{A}_t,k)$, and G and Y. Choosing the price index as the numéraire $P = rc_X(1,\omega,\tilde{A}_t)(1+\mu) = 1$, we have r and w. Average revenue and profit of domestic sales are $rev_d(\tilde{A}) = \frac{s}{s-\sigma+1}\frac{1+\mu}{\mu} f c_X(r,w,1)$ and $\pi_d(\tilde{A}) = \frac{\sigma-1}{s-\sigma+1} f c_X(r,w,1)$, and those of exporting $rev_{ex}(\tilde{A}_{ex}) = \frac{s}{s-\sigma+1}\frac{1+\mu}{\mu} f_{ex} c_X(r,w,1)$ and $\pi(\tilde{A}_{ex}) = \frac{\sigma-1}{s-\sigma+1} f_{ex} c_X(r,w,1)$. The average revenue of domestic firms is given by $r\bar{e}v = rev_d(\tilde{A}) + \rho_{ex} N rev_{ex}(\tilde{A}_{ex})$ which can be written as $r\bar{e}v = \frac{s}{s-\sigma+1}\frac{1+\mu}{\mu} c_X(r,w,1)(1+\rho_{ex}N\frac{f_{ex}}{f})$. As we have average revenue, we can find the number of domestic firms because aggregate revenue is equal to the number of domestic firms times average revenue of domestic firms: $R = Mr\bar{e}v = Y$. Hence, we have $M_t = (1+\rho_{ex}N)M$. The number of exporting firms is determined by $M_{ex} = \rho_{ex} M$. Replace in (4.35) $\tilde{A}$ by $\tilde{A}_t$ to find labor and capital demand for the fixed costs and production, additionally we have for exporting $L_{ex} = M_{ex} N f_{ex} a_X(\omega,1)$ and $K_{ex} = M_{ex} N f_{ex} b_X(\omega,1)$.

4.4.4 Simulation: Effect of Trade Liberalization

This subsection provides a simulation of the effect of trade liberalization on g_n, g and $\kappa = \frac{g_n}{g}$ when preferences are given by

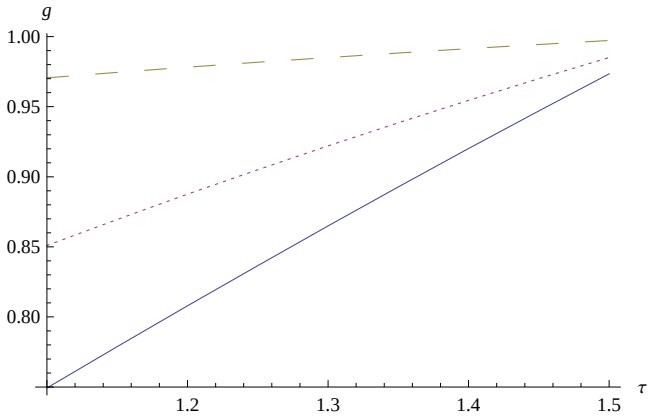
$$U = \left(Q^\beta + (\lambda G)^\beta\right)^{\frac{1}{\beta}}, \quad \beta < 0 .$$

The elasticity of substitution between public and private good is determined by $\eta = \frac{1}{1-\beta}$. Since we have $\beta < 0$, it follows that $\eta < 1$. For the production functions and hence cost functions we assume Cobb-Douglas. The cost function of the public sector is thus given by $c_G(r,w) = \left(\frac{w}{\gamma}\right)^\gamma \left(\frac{r}{1-\gamma}\right)^{1-\gamma}$. It follows for the cost minimal input coefficients in the public sector: $a_G(\omega) = \left(\omega\frac{1-\gamma}{\gamma}\right)^{\gamma-1}$ and $b_G(\omega) = \left(\omega\frac{1-\gamma}{\gamma}\right)^{\gamma}$. Cost function in the private sector is given by $c_X(r,w,\tilde{A}_t) = \tilde{A}_t^{-1}\left(\frac{w}{\alpha}\right)^\alpha \left(\frac{r}{1-\alpha}\right)^{1-\alpha}$. This implies for the cost minimal input coefficients: $a_X(\omega,\tilde{A}_t) = \tilde{A}_t^{-1}\left(\omega\frac{1-\alpha}{\alpha}\right)^{\alpha-1}$, $b_X(\omega,\tilde{A}_t) = \tilde{A}_t^{-1}\left(\omega\frac{1-\alpha}{\alpha}\right)^{\alpha}$. It is assumed that $\gamma > \alpha$ which implies that $k_X > k_G$.

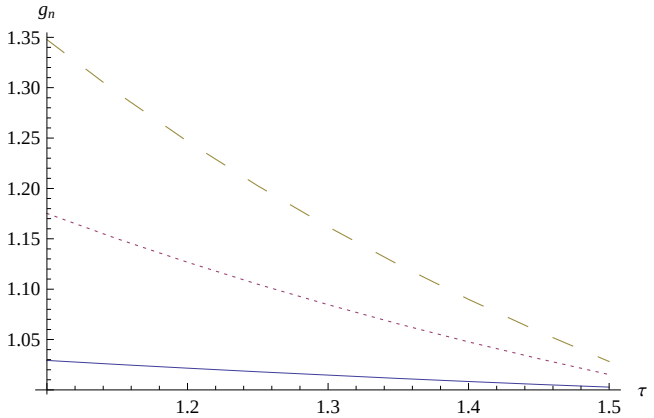
The relative price of the public sector under the assumption of Cobb-Douglas cost functions are given by $\kappa(\omega,\tilde{A}_t) = \frac{\psi_G}{\tilde{A}_t^{-1}\psi_X}\omega^{\gamma-\alpha}$ where $\psi_G = \gamma^{-\gamma}(1-\gamma)^{-(1-\gamma)}$ and $\psi_X = \alpha^{-\alpha}(1-\alpha)^{-(1-\alpha)}$. For the numerical analysis we set $\lambda = 1$ and $N = 30$. The other assumptions on parameter values are taken from Bernard et al. (2007). This is $\sigma = 3.8$, $s = 3.4$, $\bar{K} = 1200$, $\bar{L} = 1000$, $\gamma = 0.6$, $\alpha = 0.4$, $f_e = 2$, $b = 0.2$, $f = f_{ex} = 0.1$, $\delta = 0.025$, $P = 1$ (numéraire).

The dashed line corresponds to $\beta = -10 \Rightarrow \eta \approx 0.1$ (closer to the Leontief case), the pointed one to $\beta = -1 \Rightarrow \eta \approx 0.5$ and the solid curve to $\beta = -0.1 \Rightarrow \eta \approx 0.9$ (closer to the Cobb-Douglas case). There is almost no difference in κ across the different elasticities of substitutions.

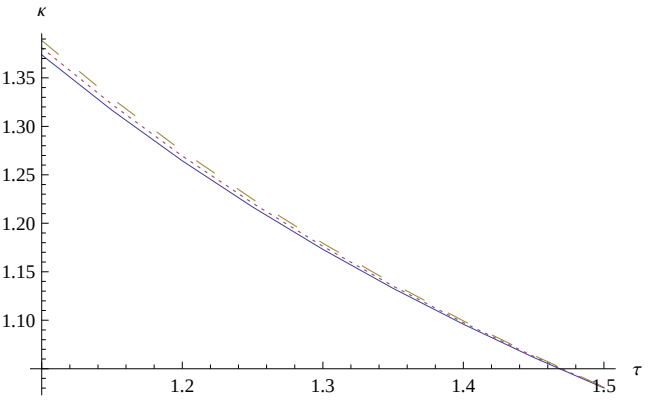
Figure 4.9: The effect of trade liberalization on the real and nominal government share and relative price of the public sector



(a) The effect of τ on g



(b) The effect of τ on g_n



(c) The effect of τ on κ

4.4.5 Tables

Table 4.1: Net FDI inflow with full sample, country fixed effects estimation

Dependent variable		p_G/p_{GDP}			gov_{cur}/gov	
	(1)	(2)	(3)	(4)	(5)	(6)
FDInetinflow	-0.018	0.014		0.011***	0.028***	
	(0.012)	(0.033)		(0.004)	(0.008)	
FDInetinflowlag			0.031			0.020*
			(0.038)			(0.011)
gov	-0.010***	-0.010***	-0.010***	-0.001***	0.000	-0.001
	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.001)
pop	-0.008	0.015	0.012	0.006*	-0.006	-0.006
	(0.010)	(0.014)	(0.015)	(0.004)	(0.006)	(0.007)
gdp	0.462***	0.383***	0.335***	0.035**	0.010	0.027
	(0.066)	(0.104)	(0.096)	(0.016)	(0.031)	(0.031)
openness	0.055***	0.166***	0.147***	-0.030***	-0.090***	-0.093***
	(0.016)	(0.046)	(0.043)	(0.008)	(0.013)	(0.013)
polity2		-0.002	-0.002		0.001**	0.000
		(0.001)	(0.001)		(0.000)	(0.000)
war		0.004	0.004		0.001	0.002
		(0.003)	(0.003)		(0.001)	(0.001)
depend		0.543***	0.516***		-0.144***	-0.160***
		(0.098)	(0.108)		(0.031)	(0.034)
urban		0.001	0.000		-0.004***	-0.003***
		(0.002)	(0.002)		(0.001)	(0.001)
blackpremium		0.005***	0.005***		-0.001	-0.000
		(0.002)	(0.002)		(0.001)	(0.001)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	3675	2066	1993	3675	2066	1993
# Countries	163	120	123	163	120	123
R^2	0.085	0.095	0.087	0.108	0.134	0.133

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.2: Net FDI inflow with OECD countries, country fixed effects estimation

Dependent variable	p_G/p_{GDP}			gov_{cur}/gov		
	(1)	(2)	(3)	(4)	(5)	(6)
FDInetinflow	0.013	0.032*		0.006**	0.016***	
	(0.013)	(0.017)		(0.003)	(0.005)	
FDInetinflowlag			0.086***			0.006
			(0.025)			(0.007)
gov	-0.017***	-0.025***	-0.026***	-0.001**	-0.000	0.000
	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)
pop	0.139	-0.780***	-0.810***	0.070**	0.200***	0.236***
	(0.133)	(0.164)	(0.176)	(0.028)	(0.035)	(0.036)
gdp	-0.253	0.906***	0.931***	-0.108***	-0.305***	-0.340***
	(0.174)	(0.253)	(0.270)	(0.037)	(0.049)	(0.050)
openness	-0.050*	-0.102	-0.124	-0.017	-0.072***	-0.058**
	(0.030)	(0.076)	(0.077)	(0.011)	(0.024)	(0.023)
polity2		0.008***	0.009***		0.000	0.000
		(0.003)	(0.003)		(0.000)	(0.000)
war		0.018**	0.009		0.007***	0.007***
		(0.008)	(0.011)		(0.002)	(0.002)
depend		-0.103	-0.128		0.013	0.017
		(0.143)	(0.144)		(0.029)	(0.030)
urban		0.005***	0.006***		-0.003***	-0.003***
		(0.001)	(0.001)		(0.000)	(0.000)
blackpremium		-0.210*	-0.191*		0.021**	0.018**
		(0.121)	(0.112)		(0.008)	(0.008)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	816	577	561	816	577	561
# Countries	30	26	26	30	26	26
R^2	0.340	0.389	0.392	0.522	0.511	0.507

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.3: Capital account with full sample, country fixed effects estimation

Dependent variable	p_G/p_{GDP}			gov_{cur}/gov		
	(1)	(2)	(3)	(4)	(5)	(6)
CA	0.646***	0.939***		-0.179***	-0.170**	
	(0.224)	(0.319)		(0.054)	(0.069)	
CAlag			0.951***			-0.154**
			(0.319)			(0.076)
gov	-0.010***	-0.010***	-0.010***	-0.001***	-0.000	-0.001*
	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.001)
pop	-0.024	-0.004	0.005	0.019***	0.007	0.002
	(0.017)	(0.018)	(0.017)	(0.007)	(0.010)	(0.009)
gdp	0.543***	0.534***	0.436***	0.001	-0.041	-0.009
	(0.071)	(0.111)	(0.104)	(0.019)	(0.036)	(0.035)
openness	0.060***	0.170***	0.150***	-0.033***	-0.088***	-0.093***
	(0.016)	(0.044)	(0.041)	(0.008)	(0.013)	(0.013)
polity2		-0.002	-0.002		0.001*	0.000
		(0.001)	(0.001)		(0.000)	(0.000)
war		0.007**	0.007**		0.001	0.001
		(0.003)	(0.003)		(0.001)	(0.001)
depend		0.513***	0.488***		-0.157***	-0.164***
		(0.102)	(0.111)		(0.032)	(0.034)
urban		0.002	0.001		-0.004***	-0.003***
		(0.002)	(0.002)		(0.001)	(0.001)
blackpremium		0.005***	0.005***		-0.001	-0.000
		(0.002)	(0.002)		(0.001)	(0.001)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	3768	2093	2020	3768	2093	2020
# Countries	165	121	123	165	121	123
R^2	0.086	0.096	0.088	0.110	0.135	0.135

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.4: Capital account with OECD countries, country fixed effects estimation

Dependent variable	p_G/p_{GDP}			gov_{cur}/gov		
	(1)	(2)	(3)	(4)	(5)	(6)
CA	0.394**	0.532***		-0.274***	-0.198***	
	(0.161)	(0.138)		(0.051)	(0.051)	
CAlag			0.517***			-0.177***
			(0.146)			(0.057)
gov	-0.017***	-0.024***	-0.024***	-0.001**	-0.000	0.000
	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)
pop	0.175	-0.790***	-0.804***	0.078***	0.227***	0.250***
	(0.138)	(0.184)	(0.197)	(0.027)	(0.035)	(0.035)
gdp	-0.281	0.957***	0.949***	-0.137***	-0.358***	-0.372***
	(0.182)	(0.284)	(0.296)	(0.036)	(0.050)	(0.050)
openness	-0.058*	-0.119	-0.146*	-0.015	-0.060***	-0.051**
	(0.030)	(0.078)	(0.079)	(0.010)	(0.023)	(0.022)
polity2		0.008***	0.008**		0.000	0.000
		(0.003)	(0.003)		(0.000)	(0.000)
war		0.006	0.006		0.005***	0.006***
		(0.012)	(0.012)		(0.002)	(0.002)
depend		-0.147	-0.183		0.018	0.020
		(0.144)	(0.145)		(0.029)	(0.029)
urban		0.005***	0.005***		-0.003***	-0.003***
		(0.001)	(0.001)		(0.000)	(0.000)
blackpremium		-0.214*	-0.202*		0.021**	0.019**
		(0.121)	(0.115)		(0.009)	(0.008)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	813	574	558	813	574	558
# Countries	30	26	26	30	26	26
R^2	0.341	0.365	0.367	0.535	0.518	0.515

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.5: Trade liberalization (Trade Freedom index) with full sample, country fixed effects estimation

Dependent variable	p_G/p_{GDP}			gov_{cur}/gov		
	(1)	(2)	(3)	(4)	(5)	(6)
tradefreedom	-0.227*	-0.230*		-0.018	-0.021	
	(0.128)	(0.131)		(0.016)	(0.017)	
tradefreedomlag			-0.138			0.006
			(0.144)			(0.018)
gov	-0.005***	-0.004**	-0.004**	-0.001*	-0.001	-0.002**
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
pop	-0.107**	-0.059	-0.079*	0.036*	0.052**	0.078***
	(0.045)	(0.037)	(0.042)	(0.019)	(0.026)	(0.030)
gdp	0.159	-0.010	0.050	0.038	-0.043	-0.080
	(0.125)	(0.148)	(0.153)	(0.045)	(0.060)	(0.067)
openness	-0.224	-0.299*	-0.164	-0.022	-0.032*	-0.028
	(0.145)	(0.175)	(0.180)	(0.014)	(0.018)	(0.019)
polity2		-0.000	-0.002		0.001	0.000
		(0.002)	(0.002)		(0.001)	(0.001)
war		-0.000	-0.002		-0.005**	-0.002
		(0.004)	(0.003)		(0.002)	(0.002)
depend		0.111	0.029		0.204**	0.220**
		(0.118)	(0.112)		(0.088)	(0.107)
urban		-0.007*	-0.005		-0.002	-0.002
		(0.004)	(0.005)		(0.002)	(0.002)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	1328	1158	1023	1328	1158	1023
# Countries	154	142	142	154	142	142
R^2	0.119	0.131	0.065	0.139	0.085	0.092

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.6: Trade liberalization (Trade Freedom index) with OECD countries, country fixed effects estimation

Dependent variable	p_G/p_{GDP}			gov_{cur}/gov		
	(1)	(2)	(3)	(4)	(5)	(6)
tradefreedom	0.128**	0.142***		-0.055	-0.031	
	(0.056)	(0.050)		(0.039)	(0.038)	
tradefreedomlag			0.136**			-0.096*
			(0.056)			(0.052)
gov	-0.008**	-0.007*	-0.006	-0.004**	-0.003	-0.007***
	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)	(0.003)
pop	1.456***	1.783***	1.583***	0.018	-0.279	-0.147
	(0.242)	(0.412)	(0.461)	(0.073)	(0.182)	(0.193)
gdp	-1.066***	-1.391***	-1.189***	-0.034	0.281*	0.175
	(0.233)	(0.367)	(0.400)	(0.073)	(0.168)	(0.168)
openness	-0.014	0.002	0.026	0.003	-0.002	0.009
	(0.019)	(0.031)	(0.027)	(0.016)	(0.020)	(0.022)
polity2		0.006	0.011		0.007*	0.005
		(0.006)	(0.008)		(0.004)	(0.005)
war		0.014	0.015		-0.010**	-0.010**
		(0.010)	(0.010)		(0.004)	(0.004)
depend		0.076	0.085		0.098	0.137
		(0.210)	(0.228)		(0.107)	(0.126)
urban		0.005***	0.004**		0.000	0.001
		(0.002)	(0.002)		(0.002)	(0.002)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	290	245	217	290	245	217
# Countries	30	28	28	30	28	28
R^2	0.714	0.453	0.419	0.630	0.496	0.536

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.7: Trade liberalization (tariff) with full sample, country fixed effects estimation

Dependent variable	p_G/p_{GDP}			gov_{cur}/gov		
	(1)	(2)	(3)	(4)	(5)	(6)
tariff	0.075	0.043		0.014	0.034	
	(0.071)	(0.075)		(0.021)	(0.021)	
tarifflag			0.060			0.019
			(0.091)			(0.021)
gov	-0.009***	-0.011***	-0.012***	-0.001**	-0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)
pop	0.066**	0.091***	0.108**	-0.006	-0.007	-0.008
	(0.032)	(0.034)	(0.042)	(0.013)	(0.013)	(0.012)
gdp	0.061	-0.038	-0.092	0.077*	0.057	0.067
	(0.133)	(0.164)	(0.194)	(0.044)	(0.046)	(0.045)
openness	-0.151*	-0.165*	-0.109	-0.041***	-0.046***	-0.045***
	(0.087)	(0.099)	(0.130)	(0.011)	(0.012)	(0.013)
polity2		-0.000	-0.003		-0.000	-0.000
		(0.003)	(0.004)		(0.001)	(0.001)
war		-0.003	-0.006		-0.002	-0.003
		(0.004)	(0.004)		(0.001)	(0.002)
depend		0.179	0.184		0.010	0.039
		(0.136)	(0.179)		(0.057)	(0.060)
urban		0.004	0.006		0.000	0.000
		(0.004)	(0.006)		(0.002)	(0.002)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	1767	1528	1432	1767	1528	1432
# Countries	158	135	135	158	135	135
R^2	0.068	0.080	0.070	0.200	0.216	0.196

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.8: Trade liberalization (tariff) with OECD countries, country fixed effects estimation

Dependent variable	p_G/p_{GDP}			gov_{cur}/gov		
	(1)	(2)	(3)	(4)	(5)	(6)
tariff	0.212	0.224		0.019	0.016	
	(0.267)	(0.382)		(0.053)	(0.079)	
tarifflag			0.542**			-0.008
			(0.234)			(0.078)
gov	-0.022***	-0.017**	-0.021**	0.002	0.003	0.003
	(0.006)	(0.007)	(0.008)	(0.001)	(0.002)	(0.002)
pop	0.649***	0.374	0.777**	0.092*	0.042	0.074
	(0.211)	(0.465)	(0.379)	(0.054)	(0.084)	(0.085)
gdp	-0.772***	-0.268	-0.703*	-0.078	-0.039	-0.069
	(0.243)	(0.512)	(0.374)	(0.058)	(0.098)	(0.094)
openness	-0.078	-0.106*	-0.134*	-0.007	-0.028	-0.012
	(0.079)	(0.061)	(0.075)	(0.023)	(0.024)	(0.022)
polity2		0.008	0.005		0.000	-0.000
		(0.005)	(0.005)		(0.001)	(0.001)
war		-0.020	-0.023		0.004	0.006
		(0.013)	(0.017)		(0.004)	(0.004)
depend		-0.778	-0.252		-0.130	-0.086
		(0.662)	(0.382)		(0.097)	(0.099)
urban		0.010*	0.011**		0.001	0.001
		(0.005)	(0.005)		(0.002)	(0.002)
Time Dummies	yes	yes	yes	yes	yes	yes
# Obs.	217	194	181	217	194	181
# Countries	15	14	14	15	14	14
R^2	0.492	0.459	0.594	0.589	0.578	0.553

Notes: Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.9: Data and Sources

Variable	Description	Source
p_G/p_{GDP}	Ratio between the price level of governments and the price level of GDP (both price levels are from Penn World Tables 6.2)	http://pwt.econ.upenn.edu/
gov_{cur}/gov	Government consumption share (in % of GDP) measured in current prices relative to the government consumption share measured in constant prices (both government consumption shares are from Penn World Tables 6.2)	http://pwt.econ.upenn.edu/
FDInetinflow	FDI inflow minus outflow (in 100 bn) from International Financial Statistics	International Monetary Fund
CA	Capital account (in 100 bn) from International Financial Statistics	International Monetary Fund
tradefreedom	Based on trade weighted average tariff rates and non-tariff barriers (in 100)	http://www.heritage.org/index/Trade-Freedom.aspx
tariff	Unweighted average import tariff rates (in 100)	http://econ.worldbank.org/
gdp	real GDP (Laspeyeres method in 2000 prices) (in 10 bn) from Penn World Tables 6.2, lagged one period	http://pwt.econ.upenn.edu/
pop	total population (in 100 m) from Penn World Tables 6.2	http://pwt.econ.upenn.edu/
gov	share of government consumption to real GDP (in %) from Penn World Tables 6.2	http://pwt.econ.upenn.edu/
*polity*2	Composite Polity index ranging from -10 (hereditary monarchy) to 10 (consolidated democracy)	http://www.systemicpeace.org/inscr/inscr.htm
depend	Dependency ratio is the share of population below 15 and beyond 64 to the population between 15 and 64 from World Development Indicators	World Development Indicators 2005, World Bank
urban	The share of total population living in urban areas from World Development Indicators	World Development Indicators 2005, World Bank
war	ACTOTAL from Major Episodes of Political Violence (MEPV) and conflict regions, range from 0 (no violence) to 10	http://www.systemicpeace.org/warlist.htm
openness	log-share of export plus import to real GDP (in %) from Penn World Tables 6.2, lagged one period	http://pwt.econ.upenn.edu/
blackpremium	Black market premium (in ‰) from Development Research Institute, NYU	www.nyu.edu/fas/institute/dri/dataset/macro_time_series_8_2005.xls

5

Summary

The link between globalization and the public sector remains an interesting and complex issue which has not ceased to be of immediate concern. The purpose of this book was to analyze the effect of globalization on government spending and to shed some light on new channels how globalization may affect the size of governments. Chapter 1 provided stylized facts about the growth and size of government spending and presented important theoretical and empirical contributions about the relationship between openness and government size of a country. It also highlighted how the chapters of this book are related to the literature and stressed their contribution.

Chapter 2 analyzed the effect of trade liberalization on optimal public good provision in a general equilibrium model with two heterogeneous countries, tradable and non-tradable industries in the private sector, and a public sector producing a consumption good. The model accounted for endogenous firm entry in the private sector and 'love of variety' in consumer preferences. It was shown that an important cost of the public sector is its negative effect on the equilibrium number of firms. However, due to the access to foreign varieties, an increase in public spending reduces the diversity of varieties available to consumers relatively less in open economies than in closed ones. Hence, the national costs of public good provision in terms of welfare are lower, the more a country is integrated into the world market. It was shown that, other things equal, high love of variety implies high costs of public good provision. That is why optimal public good provision decreases in the measure for love of variety. In return, the effect of trade liberalization on optimal public

good provision increases if consumer have high love of variety. As for the smaller country the gains from new varieties through trade are larger, the costs of public production are lower and hence the positive effect of openness on optimal public good provision stronger. Moreover, it was demonstrated that unilateral decisions on public production results in overprovision of the public good as governments do not take the negative externality into account. Hence, aggregate welfare maximization does require cooperation between the governments. Finally, public expansion can have distortionary effects on relative factor prices. Accounting for a labor intensive public sector, additionally to the 'crowding out of firms'-effect, public expansion causes a positive terms of trade effect.

The aim of Chapter 3 was to investigate empirically the effect of import diversity on government consumption and to provide evidence for the love of variety effect on government spending described in Chapter 2. The empirical investigation was based on a panel data for OECD and non-OECD countries over a time period from 1964 to 2000. It was found that the government consumption (as a share of GDP) is positively associated with the diversity of imported products, particularly when these goods are classified as differentiated. In addition, there is some evidence that the positive effect of the range of imported products on government consumption is decreasing in home market size. In sum, the evidence confirms the hypotheses derived from the theoretical analysis in Chapter 2 pretty well.

Chapter 3 did not intend to test the different existing channels against each other but intended to provide evidence for the love of variety effect on government spending. In view of Chapter 2, an interesting question to resolve would be to examine what fraction of the effect of trade openness on government size is explained by the love of variety effect compared to the fraction explained by the terms of trade effect. The theoretical model in Chapter 2 has revealed a way to separate the two explanations. We have seen that when the public sector crowds out the extensive margin of production (number of firms), the love of variety effect plays an important role. In contrast, a crowding out of the intensive margin of production (output per firm) induces the terms of trade effect. Therefore, empirical investigations should distinguish between the extensive and intensive margin of trade. There is a growing empirical trade literature which tries to separate the extensive and intensive margin of trade flows. The discussion about the nexus between

openness and government size should jump on this bandwagon.

The contribution of Chapter 4 was to distinguish between the real and nominal government share. This chapter investigated how capital market integration and trade liberalization affect the aforementioned ratio between the two government shares and the relative price level of public goods relative to private goods. The real share is assumed to be constant to account for price inelastic demand. It is shown that an inflow of capital increases the relative wage rate, pushing up the costs in the labor intensive public sector relatively more than in the private sector. This can explain an increase in the expenditure shares (relative to GDP) for public consumption goods. Capital outflow has exactly opposite effects. Trade liberalization may also increase the relative price level and expenditure shares of public goods through raising average productivity in the private sector and inducing a Baumol and Balassa-Samuelson effect. Chapter 4 also provided some empirical investigations for a large country sample and separately for OECD countries. The ratio between the nominal and real government share is mostly positively associated with net inflow of foreign direct investment. This is in line with the model's predictions. The results for trade liberalization are mixed. For OECD countries there is some evidence that trade liberalization has a positive effect on the price level of governments (relative to price level of GDP).

An important aspect that was only briefly mentioned in the introduction and not analyzed in this book is, how globalization affects the redistributive role of governments and the amount of social security payments. A substantial part of government spending is transfer payments. Also, the main catalyst for the discussion how openness affects government - the seminal work by Rodrik (1998) - had an explanation more appropriate for the social security part of government spending. Nevertheless, the focus in this book was on the role of governments as a provider of public goods. This is the budget component for which the investigated channels and explanations in the Chapters 2-4 are most appropriate.

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Curriculum Vitae

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